1/25

Binny

BASF WYANDOTTE CORPORATION - SOUTH WORKS

REMEDIAL PROGRAM

S.S.Papadopulos & Associates, Inc. undertook an investigation of the rate and direction of groundwater flow within the surficial fill materials underlying the BASF Wyandotte Corporation's South Works property. The results of the Papadopulos investigation are contained in a report dated October 1984. The Company subsequently undertook a sampling program in January of 1985 to determine the character of the groundwater. The sample locations and the compounds analyzed were reviewed and approved in advance by representatives of the Office of The Attorney General and the Department of Natural Resources. Exhibit I shows the location of the 23 observation wells that were sampled at the South Works. Exhibit II provides a tabulation of the results of the Company's analysis of such samples.

The remedial program described below is based upon the findings of the Papadopulos report and the analytical results of the Company's sampling program. The Company has concluded from the data that an affirmative remediation program is warranted in two areas of the South Works: a) the area in the vicinity of Observation Well 25, and b) the area in the vicinity of Observation Well 12 and 19. A standing water condition in the area of Observation Well 21 and 8 will also be remedied by filling and grading. The observation wells sampled in the

LD35-122,123

remaining areas of the South Works contained such low concentrations of the targeted compounds and/or have demonstrated such a minimal rate of off-site groundwater migration that an affirmative remedial program for these areas was judged to be unwarranted. The Company will, however, continue to monitor ten observation wells adjacent to the Detroit River for a period of three years.

Remedial Program For Area In Vicinity Of Observation Well 25

Observation Well 25 is located in the Southeast corner of the South Works adjacent to the Detroit River (see Exhibit I). Analysis of the groundwater sample taken from this well revealed the presence of three of the targeted organic compounds at the following levels:

1,2 dichloropropane	3,340 ppb
Tetrachloroethylene	9,350 ppb
Hexachlorobenzene	512 ppb

The groundwater in this area of the site flows in the general direction of Observation Well 25 (see Exhibit III). A french drain system has been designed for installation along a 400 foot line located 200 feet west of Observation Well 25 to intercept the flow of groundwater moving towards the Detroit River and Wye Street. The location and design details of the french drain

system to be installed are set forth in Exhibits IVa and IVb. As shown in Exhibit IVa, each drain will be 110 feet long with a spacing of about 40 feet between drains. The drains will be installed at a depth of about 15 feet near the top of the lake clay underlying the surficial materials.

Groundwater collected through the operation of this system will be discharged by pumps to the Wayne County Public Works' wastewater treatment plant pursuant to a separate agreement between Wayne County and the Company. The pumping program will be operated from May 15 to November 15 of each year for a period of 30 years, or until the concentration of 1,2 dichloropropane, tetrachloroethylene and hexachlorobenzene are each found to be below 500 ppb for three consecutive sampling periods. If these concentration levels are achieved in any portion of the french drain system, operation of that portion of the system will be discontinued.

Groundwater samples will be collected and analyzed from each portion of the french drain system during June and October of each year that that portion of the system is in operation. Groundwater samples will be analyzed for 1,2 dichloropropane, tetrachloroethylene and hexachlorobenzene.

Remedial Program For Area In The Vicinity Of Observation Well 12 and 19

Observation Well 12 and 19 are located approximately 500 feet apart on the western edge of the South Works along Biddle Avenue

near Grove Street (see Exhibit I). Analysis of the water samples taken from these wells revealed the presence of three of the targeted organic compounds at the following levels:

	Well 12	Well 19
1,2 dichloropropane	203,000 ppb	170 ppb
Trichloroethylene	500 ppb	1,660 ppb
Tetrachloroethylene	2,000 ppb	-

The groundwater in this area of the site flows to the West in the general direction of Biddle Avenue (see Exhibit III). A system has been designed to intercept the flow of groundwater in the vicinity of Observation Well 12 and 19 and transport it to a collection point where it will be discharged to the Wayne County Public Works' wastewater treatment plant under a separate agreement between Wayne County and the Company. The location and design details of this drainage systems are set forth in Exhibits Va through Vd. The system will be operated from May 15 to November 15 of each year for a period of 30 years, or until the concentrations of 1,2 dichloropropane, trichloroethylene and tetrachloroethylene are each found to be below 500 ppb for three consecutive sampling periods. Groundwater samples will be collected and analyzed in June and October of each year that the drainage system is in operation. Groundwater samples will be analyzed for 1,2 dichloropropane, trichloroethylene and tetrachloroethylene.

Surface Grading

Standing water frequently accumulates on the surface of the South Works in the vicinity of Observation Well 21 and 8, preventing the growth of vegetative cover. The remedial program for the South Works will include grading and filling as necessary to eliminate standing water in this area. All former observation wells not subject to continued monitoring as set forth below will be plugged to prevent the entry of groundwater into the surficial materials.

Monitoring of Observation Wells

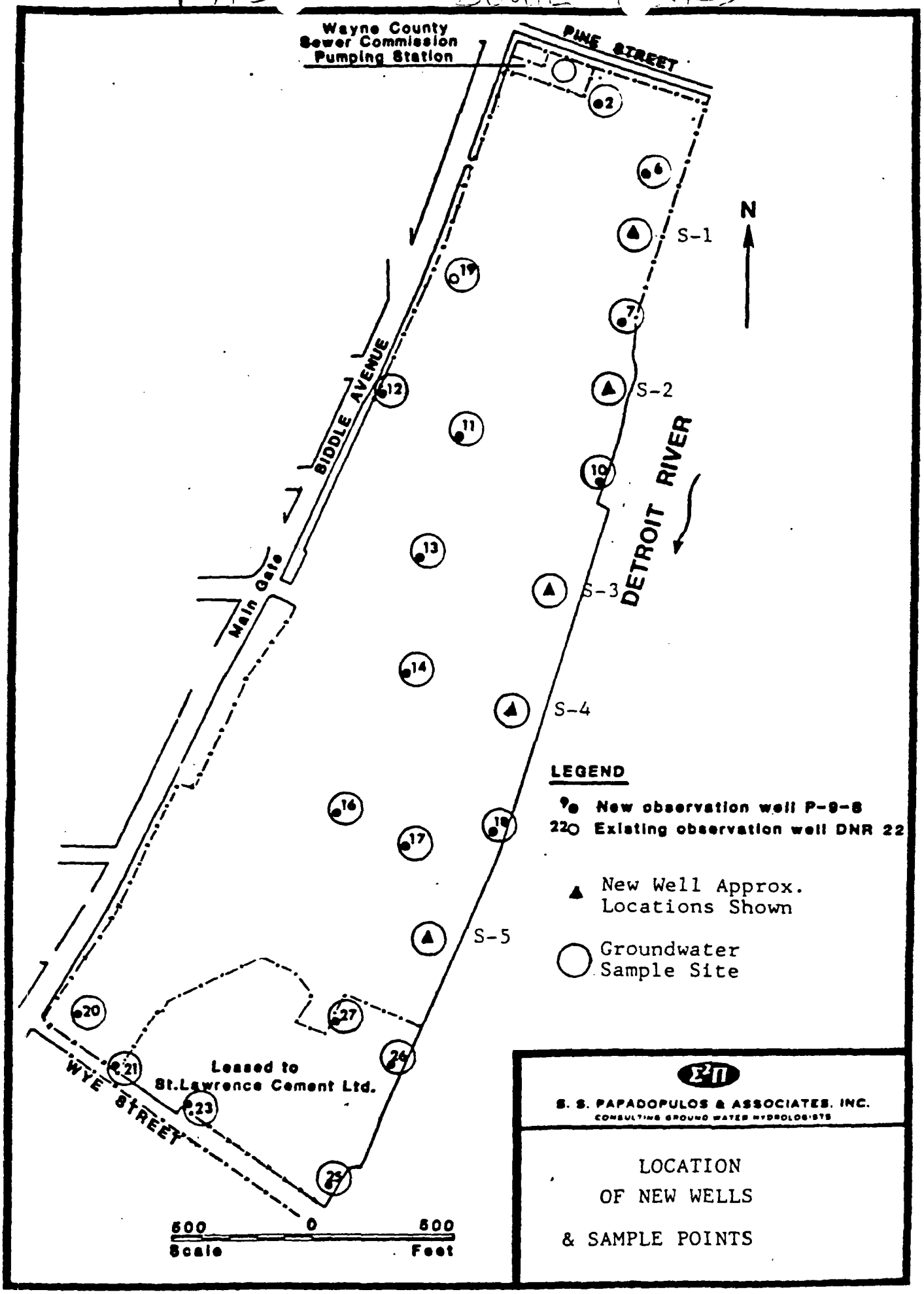
The Company will collect groundwater samples from Observation Wells 2, 6, S-1, 7, S-2, 10, S-3, S-4, 18 and S-5 and analyze each sample for 1,2 dichloropropane and tetrachloroethylene. The approximate location of these observation wells is shown in Exhibit I. A single groundwater sample from each well will be collected and analyzed during June and October of each year for a period of three years. then what?

Reporting of Groundwater Analytical Data

Prior to December 31 of each year, the Company shall provide the Department of Natural Resources, Permit Branch, with a written report of the analytical results for all South Works groundwater samples analyzed pursuant to this remedial program. The Company will further provide 30 days' prior written notice to the

Wayne County Public Works' of its intent to discontinue the sampling of any groundwater source discharging to the Wayne County Public Works' wastewater treatment facility.

BASF South Parks



(1) There are different detection limits for different analyses in the data table:

- Denotes compound was less than the detection limit of 10 ppb. If a value is listed as <10 it means the compound was detected but not quantitated at that low level.

= Denotes compound was less than the detection limit of 0.5 ppb.

* Denotes compound was less than the detection limit of 0.25 ppb.

(2) The next table presents the metals results and total organic carbon (TOC) values for each sample.

METALS

Concentration in mg/L or ppm
(except Hg)

Sample	Collected	Cd	Cu	Cr	Zn	Pb	Hg Hg/L	TOC
1D	1/2/85	+	+	+	+	+	+	0.58
2S	"	+	+	+	+	+	+	5.32
6S	"	+	+	+	+	+	+	3.89
7S	"	+	+	+	+	+	3	9.29
10S	"	+	+	+	+	+	1	3.99
11S	"	+	+	+	+	+	1	2.45
S3S	"	+	+	+	+	+	+	29.6
S5S	"	+	+	+	+	+	33	60.1
13S	1/3/85	+	0.6	+	0.1	+	7	71.2
16S	"	+	+	+	+	+	3	88.5
17S	"	+	+	+	+	+	3	103.7
18S	"	+	+	+	+	+	49	54.1
12S	"	+	+	+	+	+	+	218.9
14S	"	+	+	+	+	+	+	30.0
19S	"	+	+	+	1.4	+	+	5.50
S1S	"	+	+	+	0.1	+	+	5.61
S4S	"	+	+	+	+	+	3	255
S2S	1/4/85	+	+	+	0.1	+	13	4.20
20S	"	+	+	+	+	+	+	14.9
21S	"	+	+	+	+	+	+	4.76
23S	1/8/85	+	+	+	+	+	+	6.23
25S	"	+	+	+	+	+	+	319
26S	"	+	+	+	+	+	+	11.54
27S	"	+	+	+	+	+	1	58.7
Note: Detection limit		0.1	0.1	0.1	0.1	0.1	0.5	N/A

+ denotes compound below detection limit.

SOUTH WORKS GROUNDWATER SAMPLES
TABLE OF ESSENTIAL INFORMATION

During the first 8 days of January, 1985 24 water samples were collected from the South Works and have been analyzed for specific compounds. The results are presented below:

Sample	Date Collected	Organic Components (ug/L or ppb)[1] 1,2-dichloropropane	trichloroethylene	1,2-dichloroethylene	tetrachloroethylene	hexachlorobenzene	hexachlorobutadiene
1D	1/2/85	-	-	-	-	=	=
2S	"	-	-	-	-	=	=
6S	"	-	<10	<10	-	=	=
7S	"	-	-	<10	-	=	=
10S	"	16	-	-	-	=	=
11S	"	25	-	-	-	=	=
S3S	"	17	-	-	-	=	=
S5S	"	260	-	-	-	=	=
13S	1/3/85	553	-	-	-	=	=
16S	"	-	-	-	-	=	=
17S	"	-	<10	-	-	=	=
18S	"	113	-	-	-	=	=
12S	"	203,000	500	300	2,000	=	=
14S	"	10	-	-	-	=	=
19S	"	170	1,660	-	-	=	=
S1S	"	10	18	-	-	=	=
S4S	"	<10	<10	-	-	=	=
S2S	1/4/85	-	-	-	66	*	*
20S	"	264	-	-	26	*	*
21S	"	451	-	-	17	*	*
23S	1/8/85	<10	-	24	<10	5.7	0.25
25S	"	3,340	-	-	9,350	512	104
26S	"	<10	-	-	162	3.7	*
27S	"	15	13	-	221	18.1	0.8

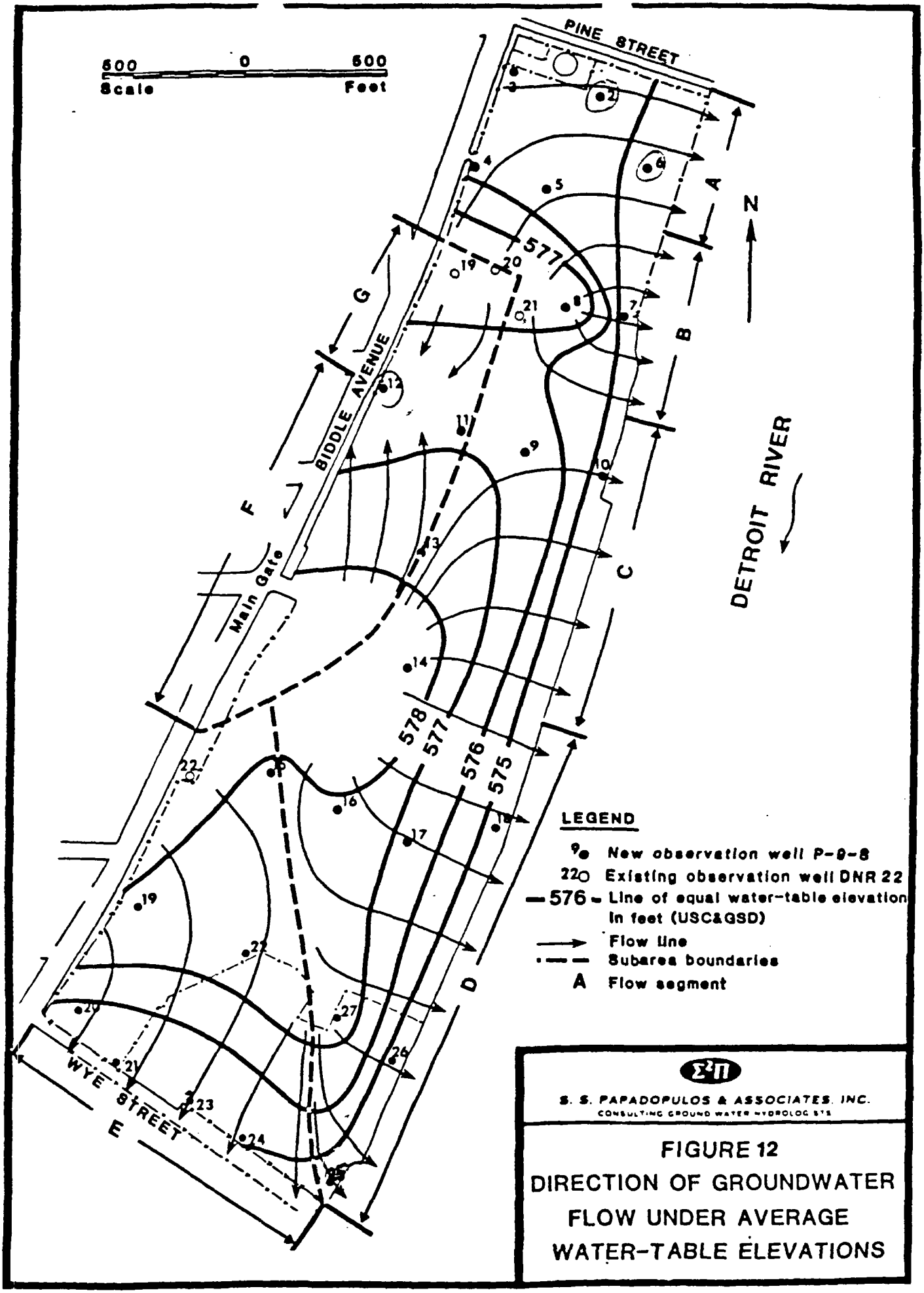
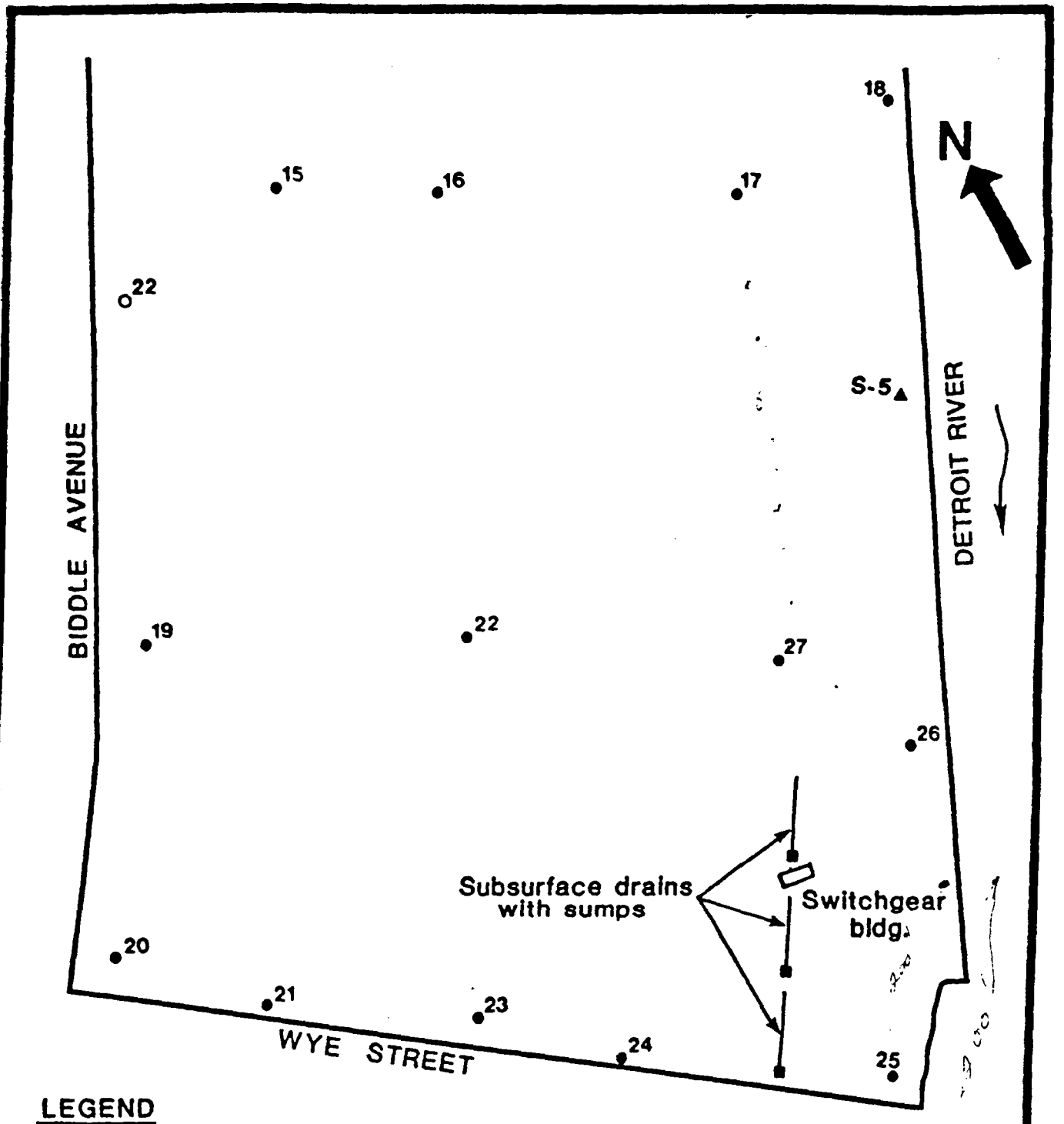

600 0 600
Scale Feet
PINE STREET
BIDDLE AVENUE
Main Gate
WYE STREET
DETROIT RIVER
N
A
B
C
D
E
F
G
577
578
576
575
LEGEND
New observation well P-8-8
Existing observation well DNR 22
576 Line of equal water-table elevation in feet (USC&GSD)
Flow line
Subarea boundaries
A Flow segment
S. S. PAPADOPULOS & ASSOCIATES, INC.
CONSULTING GROUND WATER HYDROLOGISTS
FIGURE 12
DIRECTION OF GROUNDWATER FLOW UNDER AVERAGE WATER-TABLE ELEVATIONS

EXHIBIT III



LEGEND

17 ● New observation well P-17-S

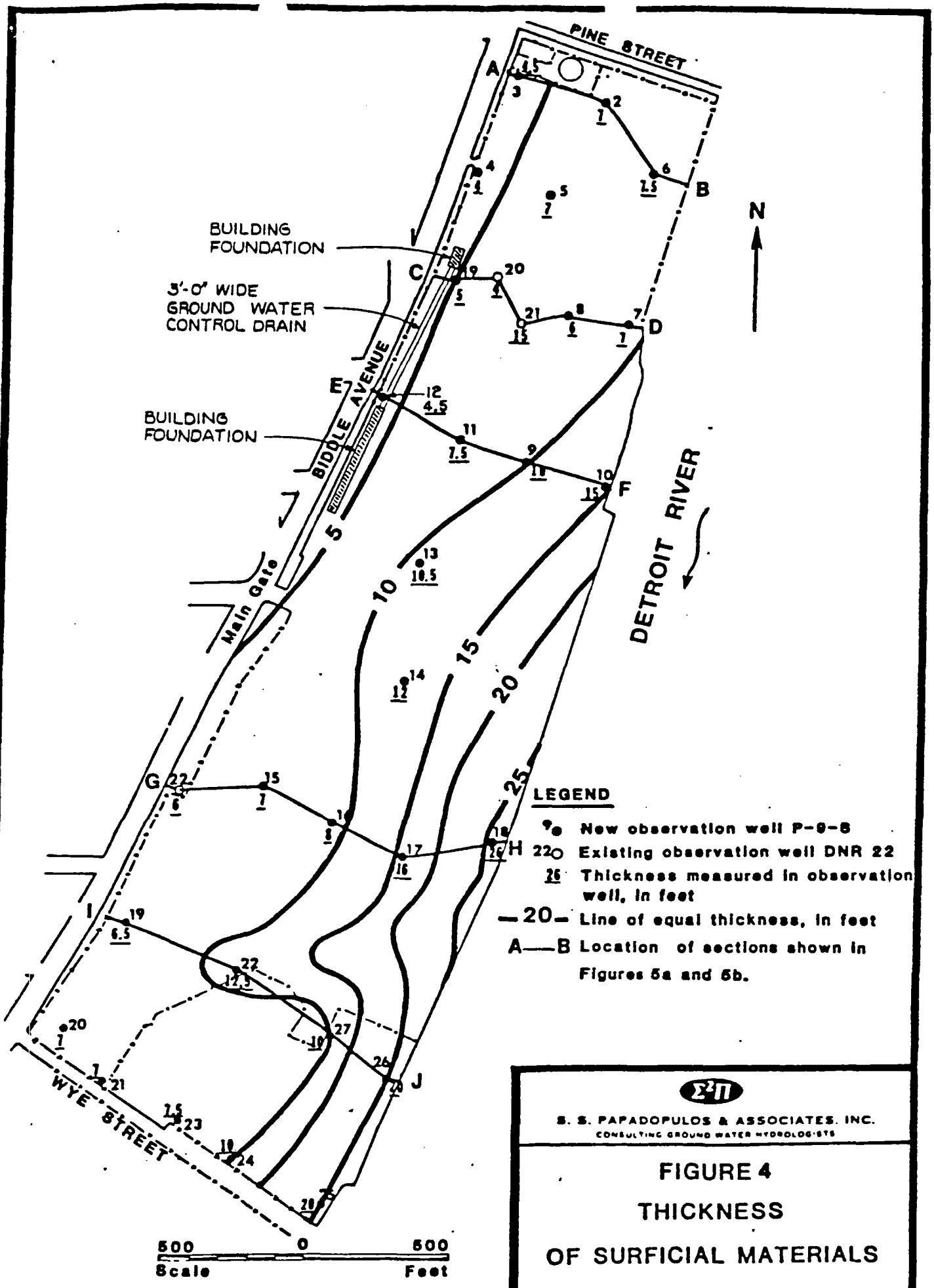
22 o Existing observation well DNR 22

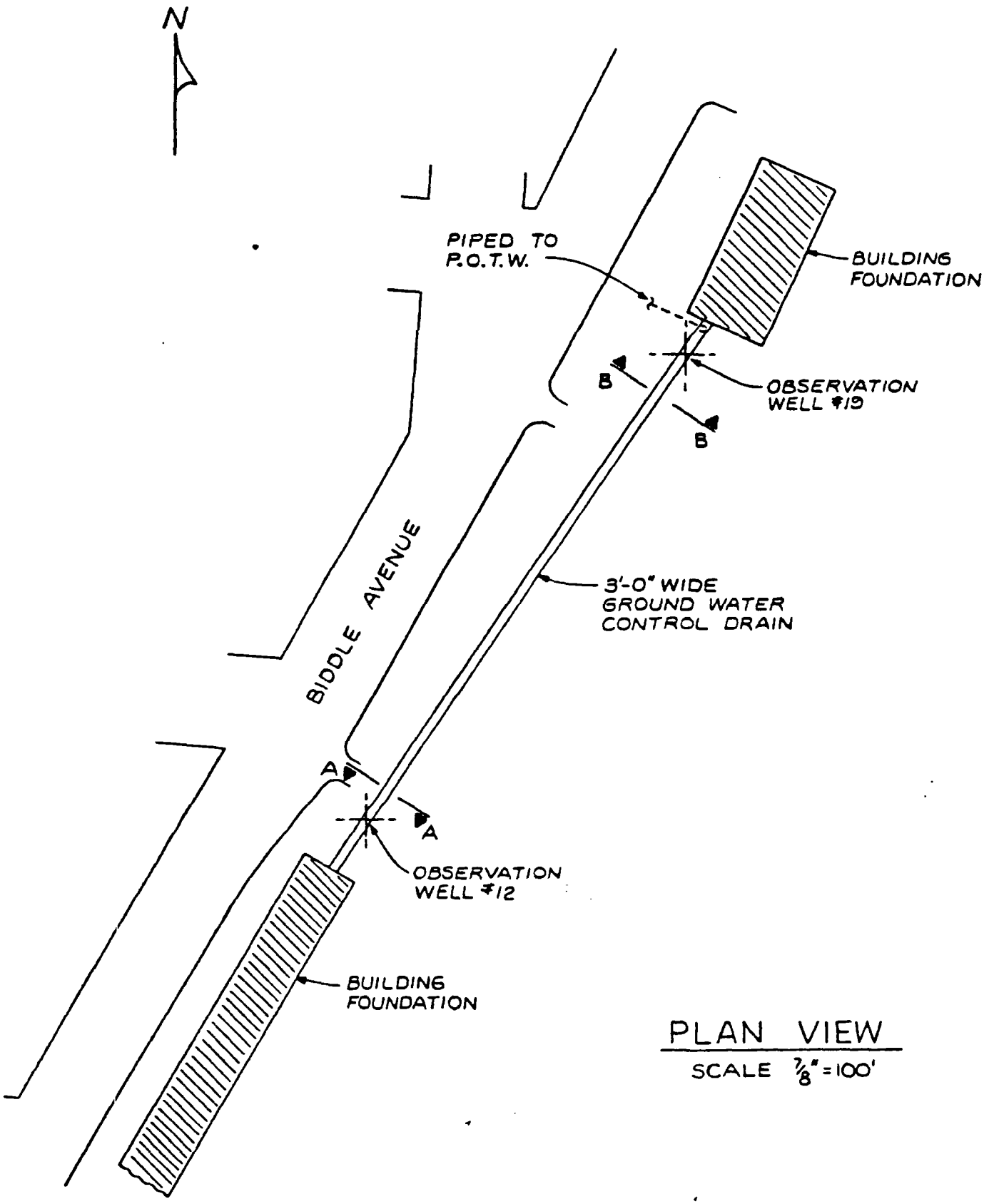
S-5 ▲ New sampling well

200 0 200

scale feet

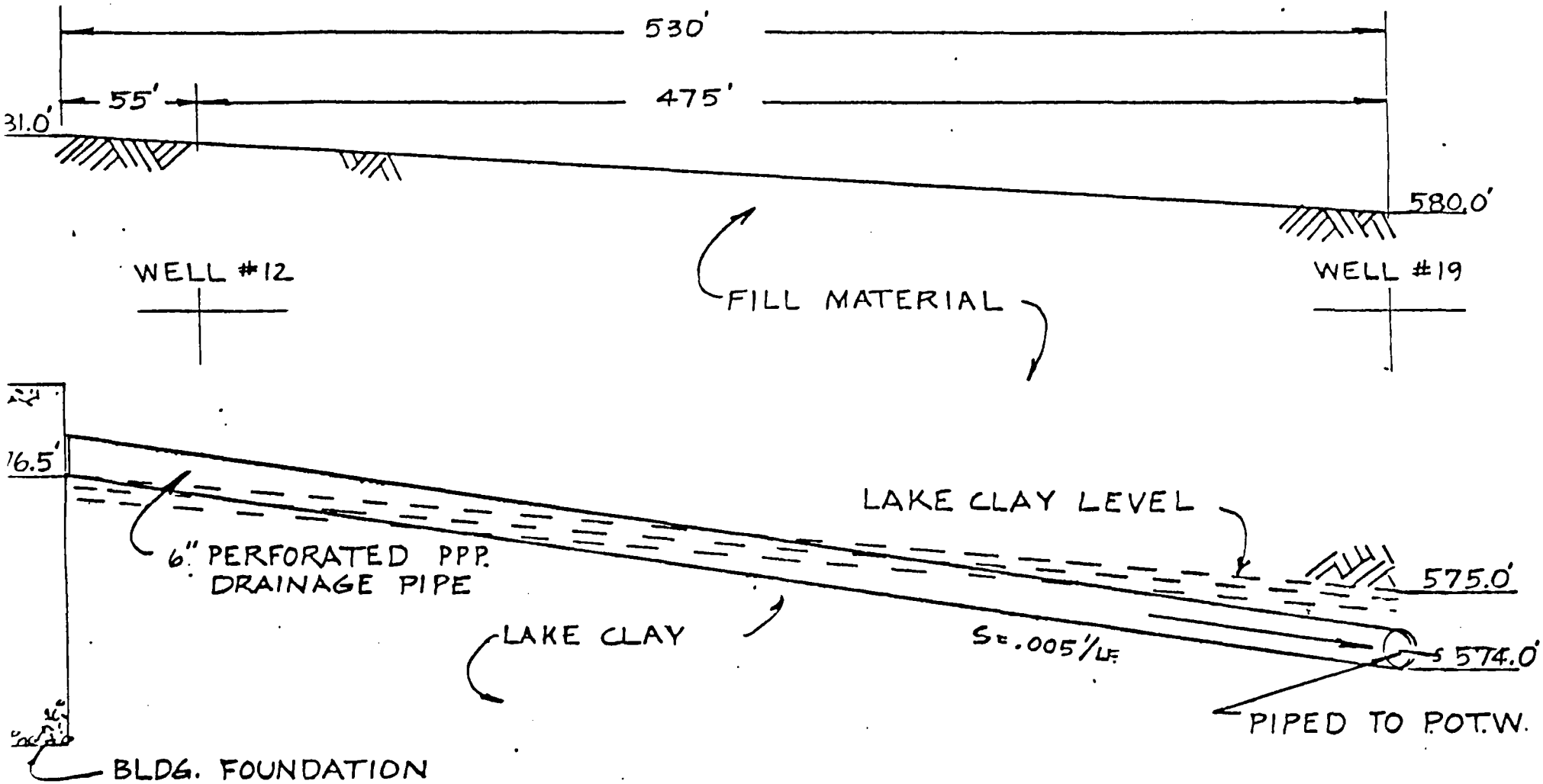
REMEDIAL PLAN FOR
THE P-25-S AREA
OF SOUTH WORKS


PINE STREET
BUILDING FOUNDATION
3'-0" WIDE GROUND WATER CONTROL DRAIN
BIDDLE AVENUE
BUILDING FOUNDATION
Main Gate
WYE STREET
DETROIT RIVER
N
A
B
C
D
E
F
G
H
I
J
5
10
15
20
25
LEGEND
New observation well P-9-8
Existing observation well DNR 22
Thickness measured in observation well, in feet
—20— Line of equal thickness, in feet
A—B Location of sections shown in Figures 5a and 5b.
500 0 500
Scale Feet
S. S. PAPADOPULOS & ASSOCIATES, INC.
CONSULTING GROUND WATER HYDROLOGISTS
FIGURE 4
THICKNESS
OF SURFICIAL MATERIALS



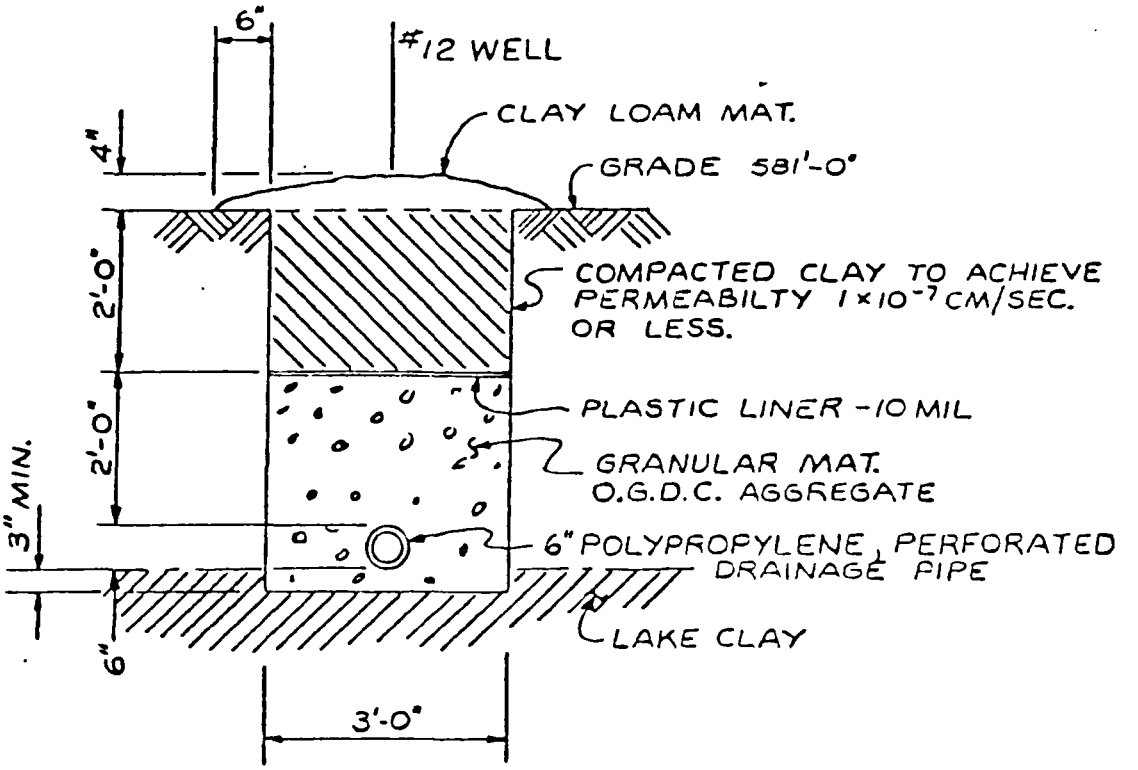
PLAN VIEW

SCALE 1/8" = 100'

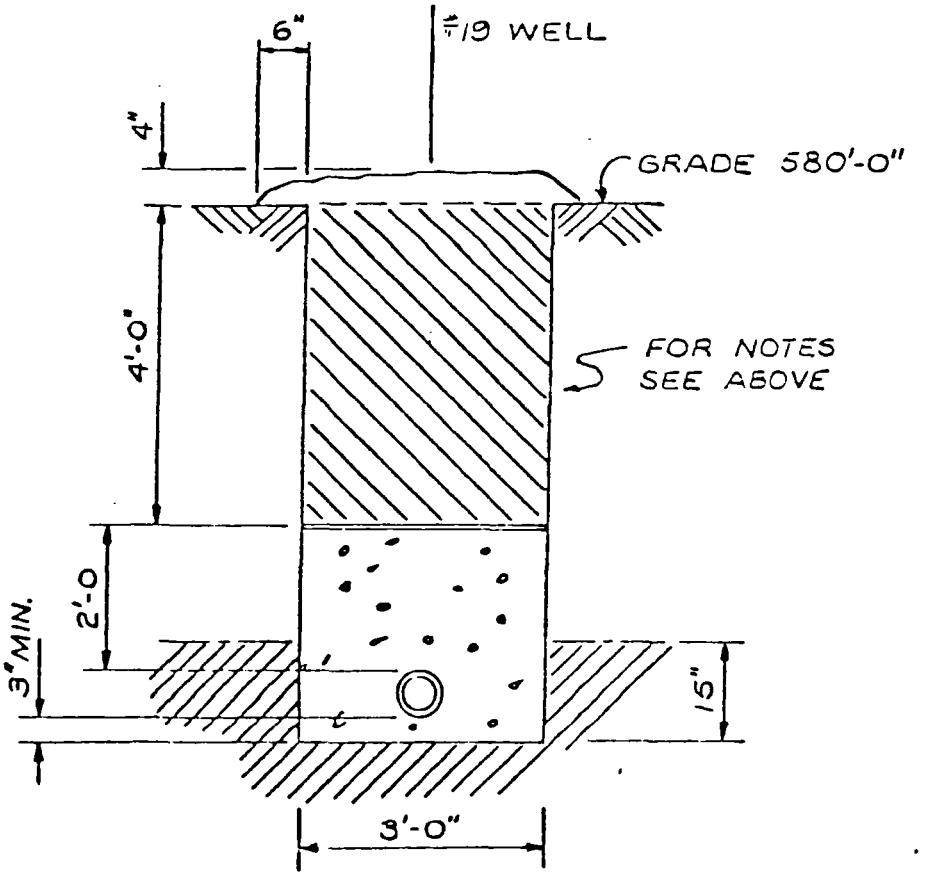


PROFILE

SCALE: VERT. $\frac{1}{2}$" = 1'
HORIZ. 1" = 50'


6"
#12 WELL
CLAY LOAM MAT.
4"
GRADE 581'-0"
2'-0"
COMPACTED CLAY TO ACHIEVE PERMEABILTY 1×10⁻⁷ CM/SEC. OR LESS.
2'-0"
PLASTIC LINER - 10 MIL
GRANULAR MAT. O.G.D.C. AGGREGATE
3" MIN.
6" POLYPROPYLENE, PERFORATED DRAINAGE PIPE
6"
LAKE CLAY
3'-0"

SEC. A-A


6"
#19 WELL
4"
GRADE 580'-0"
4'-0"
FOR NOTES SEE ABOVE
2'-0
3" MIN.
15"
3'-0"

SEC. B-B

APPENDIX A

PROPERTY DESCRIPTION NORTH and SOUTH WORKS

NORTH WORKS

The land located in the City of Wyandotte, Wayne County, State of Michigan described as being part of fractional Sections 21 and 28, T. 3 S., R. 11 E. and generally described as being bounded on the north by Perry Place, on the east by the U.S. Harbor Line of the Detroit River, on the south by Mulberry Street and of the west by Biddle Avenue. Exhibit I, Appendix B is a generalized map of the North Works.

SOUTH WORKS

The land located in the City of Wyandotte, Wayne County, State of Michigan, described as being part of fractional Section 32, T. 3 S., R. 11 E. and generally described as being bounded on the north by Pine Street, on the east by the U.S. Harbor Line of the Detroit River, on the south by Wye Street and on the west by Biddle Avenue. Exhibit I, Appendix C is a generalized map of the South Works.

11/07/85

APPENDIX B

N O R T H W O R K S

REMEDIAL PROGRAM

INTRODUCTION

BWC will undertake a remedial program that addresses the movement of groundwater towards the Detroit River and the City of Wyandotte sewer system from Locations A, B and C as shown on Exhibits I through V of this appendix.

A. EXTRACTION SYSTEMS

A groundwater extraction system shall be installed in Locations A, B, and C. The approximate position of each extraction system is shown on Exhibit I. Exhibits II, III and IV provide information on the number and placement of extraction wells and piezometers for Locations A, B and C respectively. The number of wells and the rate of withdrawal from the wells for each location shall be at all times sufficient to halt the flow of contaminated groundwater to the Detroit River and the City of Wyandotte sewer system by maintaining a hydraulic gradient toward the extraction wells.

BWC shall maintain the extraction wells including cleaning, replacement of screens and replacement of any extraction well that will not produce water due to failure of well components. A piezometer system shall be installed and the water level will be measured on the schedule established in paragraph D of this appendix, to demonstrate the creation and maintenance of an inward hydraulic gradient at Locations A, B and C.

B. TREATMENT SYSTEMS

A groundwater treatment system(s) shall be installed to treat the water removed by each extraction well system pursuant to the Implementation Schedule. BWC shall maintain the treatment system(s) until the conditions for cessation of operation are met.

C. IMPLEMENTATION SCHEDULE

BWC shall complete installation of the remedial program described in this appendix on or before December 31, 1986.

BWC shall develop the basis of design of an activated carbon system, or its equivalent, construct such system and commence its operation on or before December 31, 1986. The basis of design and the final process flow diagram and operations manual shall be submitted to MDNR for review and approval which shall be completed within thirty (30) days of submittal.

D. MONITORING

Piezometers/monitor wells shall be installed in Locations A, B and C approximately as shown on Exhibits II through IV. The specific locations of the piezometers and monitor wells shall be described on as built plans.

The water level in each piezometer, and each extraction well shall be measured monthly for the first year following installation of the piezometers and quarterly thereafter. BWC shall demonstrate that an inward hydraulic gradient toward each extraction well system exists that is adequate to halt the flow of contaminated groundwater from the North Works to the Detroit River. Thereafter, the water level elevation in each piezometer shall be measured quarterly.

MONITORING (Continued)

BWC shall operate all extraction and treatment systems for a period of not less than 15 years. Following that period, BWC may give notice of intent to discontinue operation of any extraction well, extraction system or treatment system if six (6) consecutive samples collected in June and October in each of three (3) consecutive years from such well(s), extraction system, treatment system and associated monitoring well(s) demonstrate that the required concentration levels of contaminants have been achieved, or BWC can demonstrate that the concentration of the chemicals identified in the basis of design are no longer effectively being removed by the treatment system. "The required concentration levels of contaminants" means that the concentrations of contaminants identified in the basis of design of the treatment system(s) are less than the level of detectibility described in this paragraph D. If such demonstration is made, such extraction well, extraction system or treatment system may be plugged and abandoned in accordance with the procedures set forth in Paragraph VI of the Consent Decree. In any event, as of the beginning of the twenty-sixth (26th) year of the operation of the system, BWC shall commence such collection and analysis of samples from each extraction well and monitor well then in operation, which collection and analysis shall continue until the end of the thirty (30) year period provided by the Consent Decree. The samples shall be analyzed for the chemicals listed in the basis of design of the treatment system(s).

All analysis required under this Consent Decree shall use EPA Method 624 or 625 as published in the Federal Register on October 26, 1984. Concentrations shall be reported in detectable amounts based on ten (10) times signal-to-noise ratio. When using EPA Method 625, a 1000 ml water sample shall be concentrated to 2 ml of extract.

E. OPERATION OF THE SYSTEMS

Groundwater extracted and treated by the systems described in the Consent Decree, shall be discharged to the Wayne County Department of Public Works' Wastewater Treatment Plant in accordance with a permit to discharge issued by Wayne County to BWC or to the surface waters under an NPDES permit issued by the State to BWC.

F. OTHER CONDITIONS

Within thirty (30) days of the receipt of any influent or effluent data required under this remedial program, BWC shall provide the Department of Natural Resources with the numerical results.

BWC will provide thirty (30) days prior written notice to the Wayne County Public Works of its intent to discontinue the sampling of any groundwater source discharging to the Wayne County Public Works' Wastewater Treatment Plant.

BWC shall make application to discharge the groundwater collected from these remedial systems to the Wayne County Public Works' Wastewater Treatment Plant. In the event the characteristics of the groundwater require Wayne County to impose pretreatment as a condition precedent to discharge, BWC may elect to comply with the County's pretreatment requirements or, alternatively, BWC may make application for direct discharge to the Detroit River. In the event Wayne County is required to reject the groundwater discharge from any of the above systems, BWC shall make application for the direct discharge of such groundwater

OTHER CONDITIONS (Continued)

to the Detroit River. Should BWC make application for a permit to discharge groundwater to the Detroit River, the Michigan Department of Natural Resources shall review the application in accordance with then applicable regulations and shall not unreasonably deny the permit. Provided BWC (a) gives notice to MDNR within five (5) working days of receipt of notice by the County of its intent to reject BWC's discharge, (b) applies for a permit for direct discharge to the Detroit River within sixty (60) days following receipt of such notice by the County, and (c) takes all reasonable steps necessary to maintain a permitted discharge to the POTW during the period following the County's adoption of the pretreatment requirements, the groundwater collection systems shall not be operated unless a permit to discharge to Wayne County or, alternatively, to the Detroit River, has been issued and remains in effect. If BWC challenges the necessity for or the validity of any permit condition, BWC shall construct, maintain and operate treatment technology which has been agreed upon by the parties or which has been determined to be appropriate by this Court under Paragraph VII.C. of the Consent Decree until such challenge(s) has been resolved.

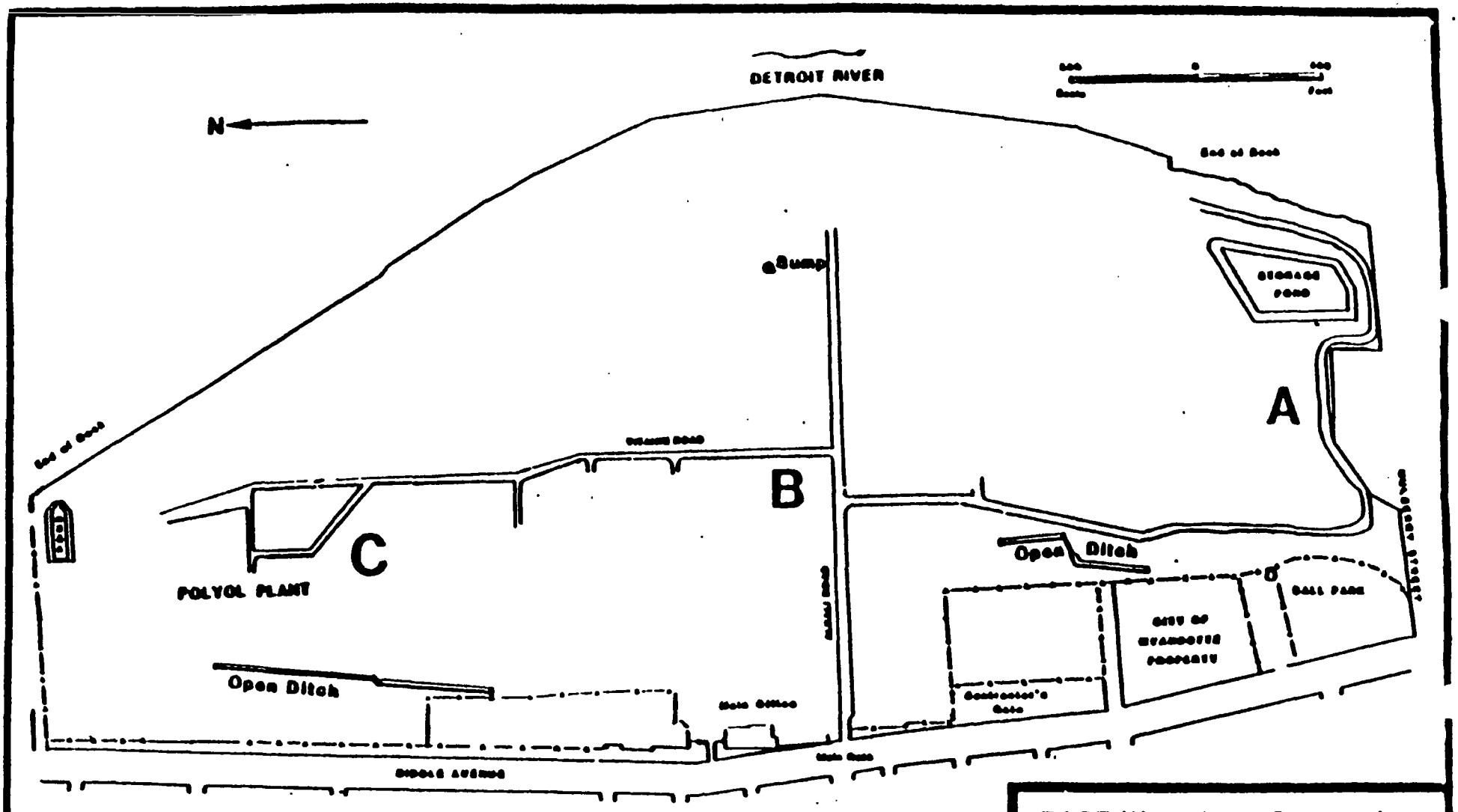
Upon application by BWC at any time after a fifteen (15) year period, the Department of Natural Resources shall determine whether the operation of any of the above systems or parts thereof is no longer necessary to comply with conditions established by then existing law or regulations. If the operation of such system(s) is not required, it may be discontinued. BWC shall bear the bur-

OTHER CONDITIONS (Continued)

den of persuasion by a preponderance of the evidence that continued operation of the system(s) is no longer necessary.

All former observation wells will be plugged.

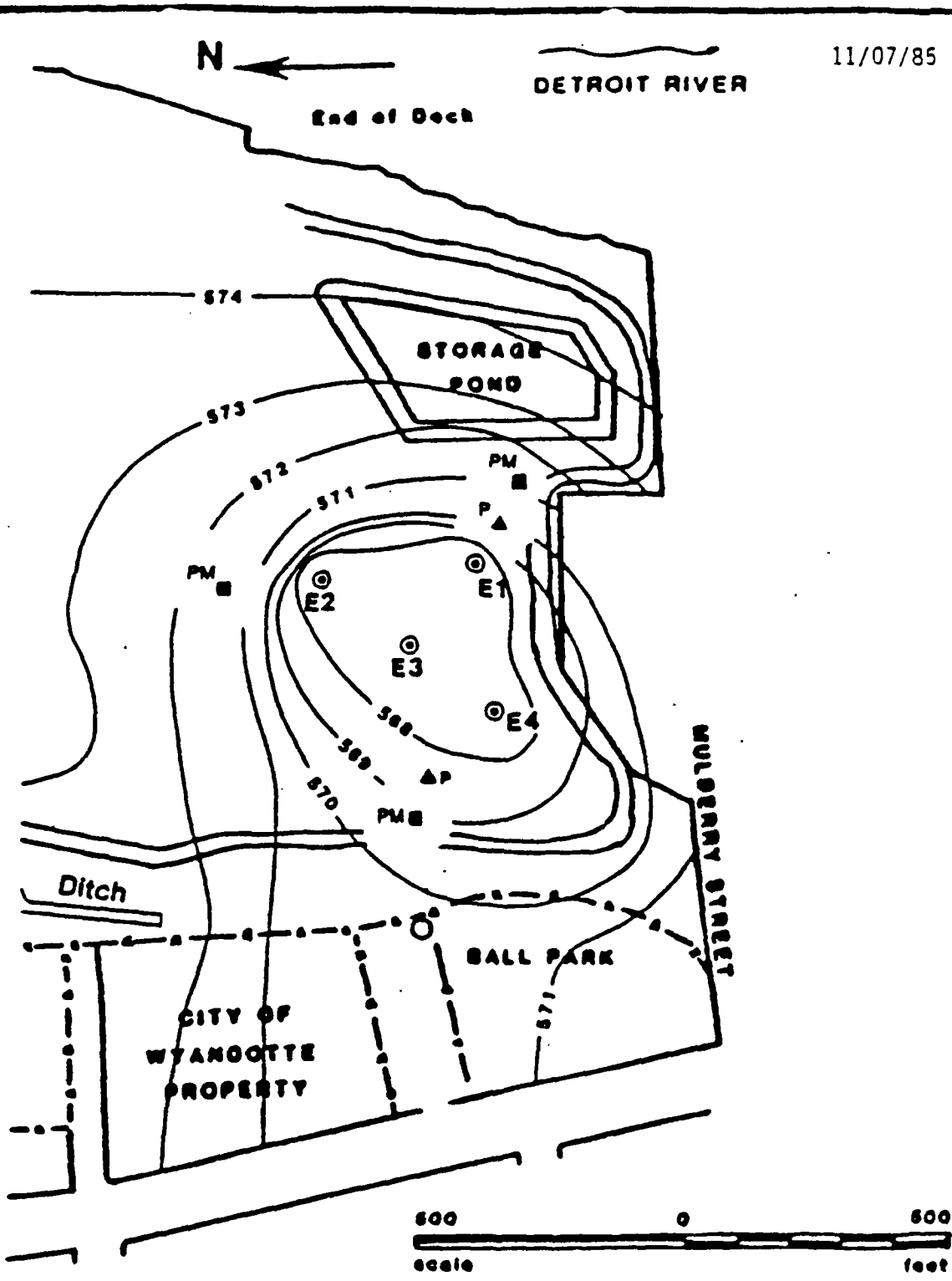
Soils and sludges excavated during construction of any groundwater collection system shall be managed in accordance with the law.



BASF Wyandotte Corporation
NORTH WORKS

EXHIBIT I
LOCATIONS

11/07/85

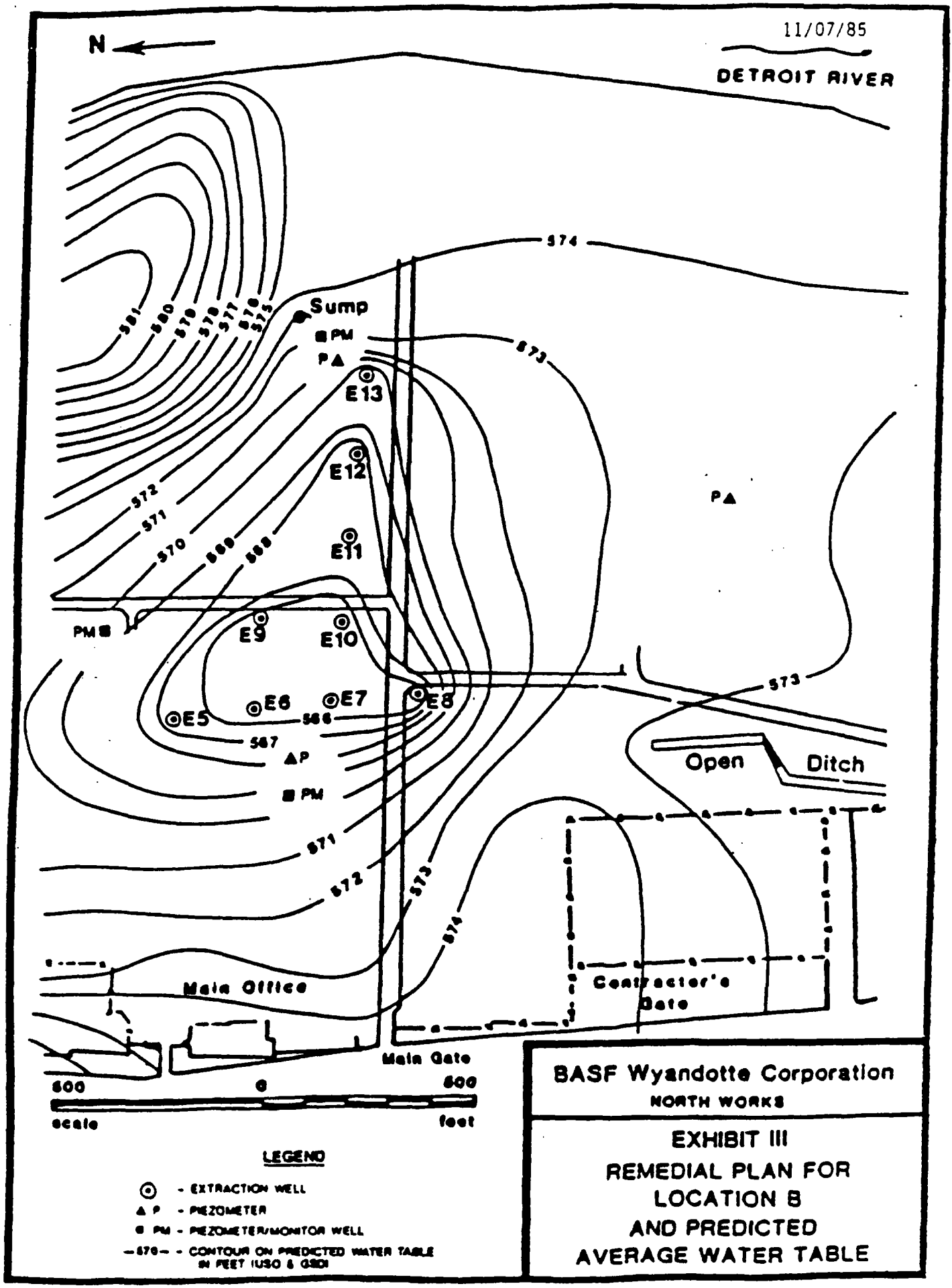


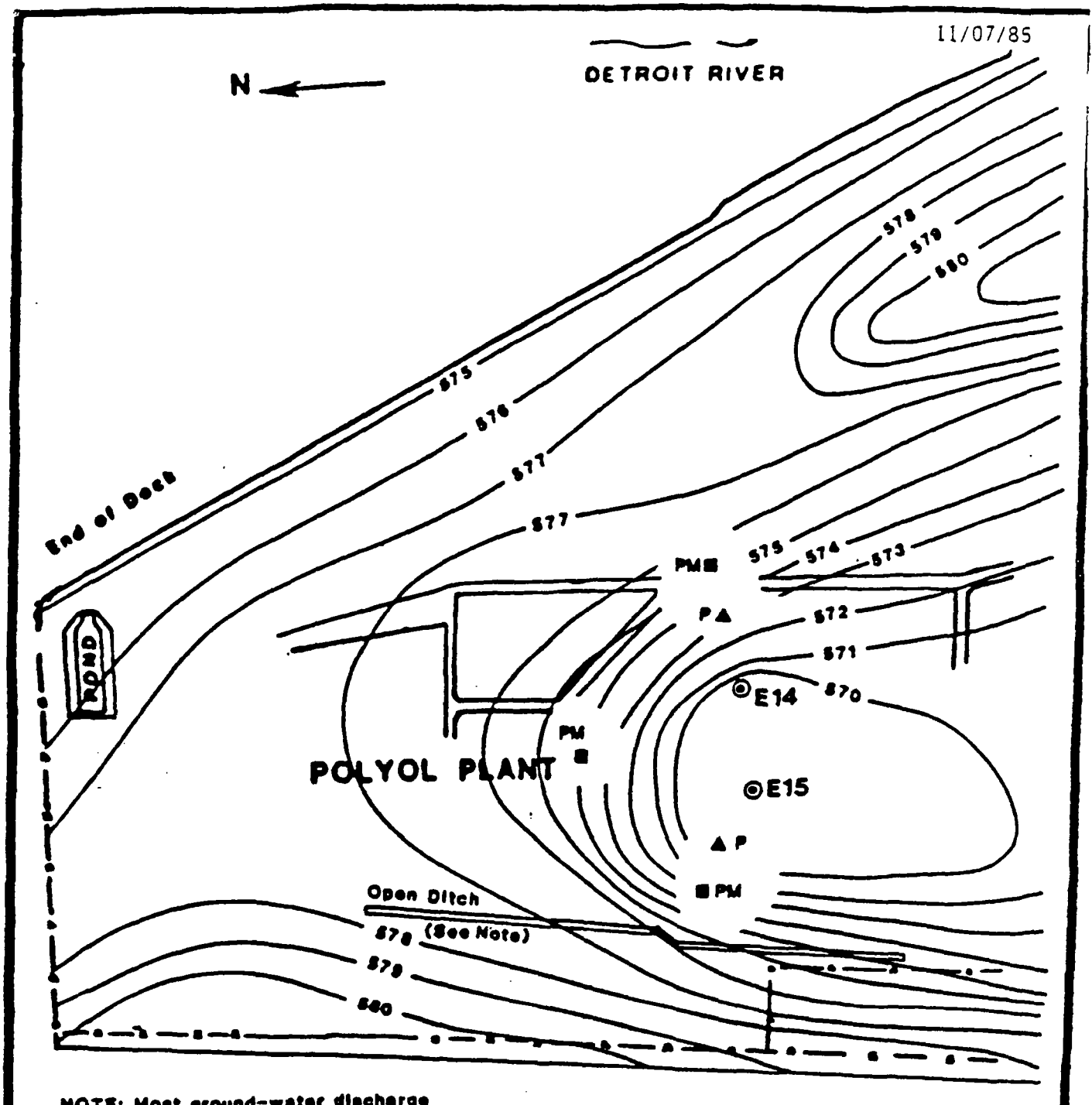
LEGEND

- ⊙ - EXTRACTION WELL
- ▲ P - PIEZOMETER
- ■ PM - PIEZOMETER/MONITOR WELL
- -570- - CONTOUR ON PREDICTED WATER TABLE IN FEET (USC & GSD)

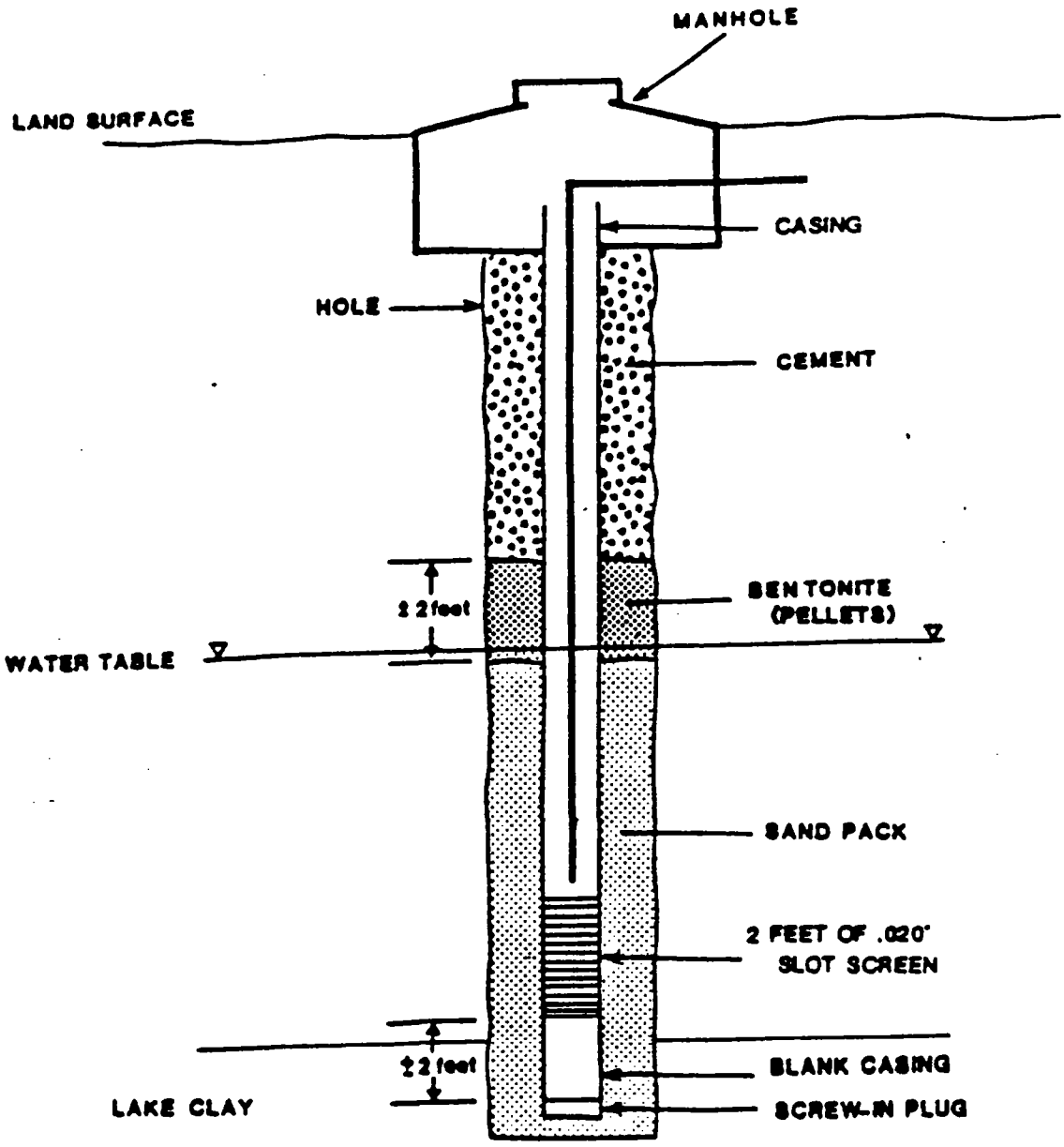
BASF Wyandotte Corporation
NORTH WORKS

EXHIBIT II
REMEDIAL PLAN FOR LOCATION A AND PREDICTED AVERAGE WATER TABLE


11/07/85
N
DETROIT RIVER
574
573
572
571
570
569
568
567
566
581
580
579
578
577
576
575
Sump
PM
P
E13
E12
E11
E10
E9
E8
E7
E6
E5
Open Ditch
Main Office
Main Gate
Contractor's Gate
500
0
500
scale
feet
LEGEND
- EXTRACTION WELL
P - PIEZOMETER
PM - PIEZOMETER/MONITOR WELL
-570- - CONTOUR ON PREDICTED WATER TABLE IN FEET (USGS & GSDI
BASF Wyandotte Corporation
NORTH WORKS
EXHIBIT III
REMEDIAL PLAN FOR
LOCATION B
AND PREDICTED
AVERAGE WATER TABLE


11/07/85
N
DETROIT RIVER
End of Dock
POND
POLYOL PLANT
PM
P
E14
E15
PM
Open Ditch
(See Note)
575
576
577
577
578
579
580
575
574
573
572
571
570
578
579
580
NOTE: Most ground-water discharge into ditch eliminated during system operation.
600
0
600
scale
feet
LEGEND
⊙ - EXTRACTION WELL
▲ P - PIEZOMETER
■ PM - PIEZOMETER/MONITOR WELL
—570— - CONTOUR ON PREDICTED WATER TABLE IN FEET (USO & GSDI
BASF Wyandotte Corporation
NORTH WORKS
EXHIBIT IV
REMEDIAL PLAN FOR
LOCATION C
AND PREDICTED
AVERAGE WATER TABLE

11/07/85



BASF Wyandotte Corporation
NORTH WORKS

EXHIBIT V
CONSTRUCTION DETAILS
OF EXTRACTION WELLS

APPENDIX C

SOUTH WORKS

REMEDIAL PROGRAM

INTRODUCTION

BWC will undertake a remedial program for the South Works that addresses: the movement of groundwater towards the Detroit River in Area A and Area B; the presence of materials of concern in a deposit of gray solids in Area C; the tendency of water to pond in the surface in Area C; and the movement of groundwater toward Biddle Avenue in Area D.

A. REMEDIAL PROGRAM FOR AREA A

Area A is located in the southeast corner of the South Works adjacent to the Detroit River (Exhibit I).

The groundwater in this area of the site flows in the general direction of the Southeastern boundary of the site (Exhibit II). A subsurface drain system will be installed along a 400 foot north-south line located 200 feet west of the shoreline which shall halt the flow of groundwater moving from Area A toward the Detroit River and Wye Street. The location and design details of the system to be installed are set forth in the Exhibits III, IV, and V. The drain will be installed at a depth of about 15 feet near the top of the lake clay underlying the surficial materials in this area. A water level measuring device with an accuracy of $\pm$ 0.1 feet shall be installed in the sump.

Groundwater collected through the operation of this system will be discharged to the Wayne County Public Works' Wastewater Treatment Plant in accordance with a discharge permit issued by Wayne County to BWC. Groundwater will be collected and analyzed from the system during June and October of each year the system is in operation and analyzed for 1,2-dichloropropane, tetrachloroethylene and hexachlorobenzene.

B. REMEDIAL PROGRAM FOR THE AREA B

Area B lies along the river front north of Area A (Exhibit I).

Groundwater extraction wells will be installed as shown on Exhibit III on 200 ± 50 foot centers 225 ± 25 feet landward from the face of the dock on the Detroit River. The construction details for the extraction wells are shown in Exhibit VI of this appendix. The number of wells and the rate of withdrawal of water therefrom shall at all times be sufficient to halt the flow of contaminated groundwater from Area B to the Detroit River by maintaining the groundwater level in each extraction well at elevation 568 feet or lower. Samples will be collected from the combined flow of all extraction wells in June and October of each year the system is in operation and analyzed for carbon tetrachloride.

The MDNR may designate two (2) extraction wells in the system to be maintained as monitor wells.

BWC shall maintain the extraction wells including cleaning, replacement of screens and replacement of any extraction well that will not produce water due to failure of well components. Water removed by the extraction wells shall be discharged to the Wayne County Department of Public Works' Wastewater Treatment Plant in accordance with a discharge permit issued by Wayne County to BWC. A piezometer system shall be installed and water level will be measured on the schedule established in paragraph F of this appendix, to establish the long term pumping rate for each extraction well.

C. REMEDIAL PROGRAM IN AREA C

Area C is located in the northern third of the site as shown in Exhibit I. BWC shall install an extraction well system as shown in Exhibit VII. The number of wells and the rate of withdrawal of water therefrom shall at all times be sufficient to halt the flow of contaminated groundwater from leaving Area C and to maximize the pore displacement of the system by maintaining the groundwater level at elevation no higher than 563 feet at Extraction Well No. 5 as shown on Exhibit VIII of this appendix. The water from the extraction well system will discharge via a piping system to the Wayne County Department of Public Works' Wastewater Treatment Plant in accordance with a discharge permit issued by Wayne County to BWC. The construction details are shown in Exhibits VIII and IX.

Samples will be collected and analyzed from the combined flow from all extraction wells in June and October each year the system is in operation for hexachlorobenzene, hexachlorobutadiene and trichloroethylene.

The remedial program for this area will include grading and filling as necessary to eliminate standing water.

D. REMEDIAL PROGRAM FOR AREA D

Area D is located on the western edge of the South Works along Biddle Avenue, as shown on Exhibit I of this appendix.

The groundwater in this area of the site flows to the west in the general direction of Biddle Avenue (Exhibit II). A subsurface drain system will be installed

REMEDIAL PROGRAM IN AREA D (Continued)

which shall collect the groundwater in Area D and discharge the water collected to the Wayne County Department of Public Works' Wastewater Treatment Plant in accordance with a discharge permit issued by Wayne County to BWC. The location and design details of this drainage system are set forth in Exhibits V and X. A system shall be installed to measure the water level at or near the point of discharge.

Groundwater samples will be collected and analyzed from this system in June and October of each year that the drainage system is in operation for 1,2 dichloropropane, trichloroethylene, and tetrachloroethylene.

A system of three (3) piezometers will be installed in the vicinity of Area D to demonstrate that the slope of the groundwater table is in the direction of the drainage system described above. In the event the building foundations are removed or found not to represent a barrier to the movement of groundwater toward Biddle Avenue during the agreed upon period of operation of the drainage system, the drainage system shall be extended as needed to collect groundwater from Area D.

E. IMPLEMENTATION SCHEDULE

BWC shall complete installation of the remedial program for the South Works on or before December 31, 1986.

F. MONITORING

1. PURPOSE OF MONITORING

The purpose of the water level and water quality monitoring provisions is to determine whether the remedial systems are meeting the requirements of this Consent Decree.

2. WATER LEVELS

Piezometers, extraction wells and monitor wells shall be installed in Areas A and B at the approximate locations shown in Exhibit III by December 31, 1986.

The water level in each piezometer and each extraction well in Areas A, B and D shall be measured monthly for the first year following installation of the piezometers and quarterly thereafter until a demonstration has been made that the collection systems have halted the flow of contaminated groundwater from these areas. Once this demonstration has been made and reported to the MDNR, no further water level measurements will be required and the piezometers may be plugged unless MDNR, for good cause shown, can demonstrate a need for continuation of the water level measurements within sixty (60) days of receipt of the report.

WATER LEVELS (Continued)

The piezometer system required under the program for Area D shall be installed and the required water level measurements will commence within one (1) year after completion of the collection system. The water level shall be measured monthly in each piezometer and in monitor wells MW-3, MW-4, and MW-5 for one (1) year and quarterly thereafter until a demonstration has been made that the flow of contaminated groundwater to the Detroit River has been halted. Once this demonstration has been made and reported to the MDNR, no further water level measurements will be required and the piezometers may be plugged unless MDNR, within sixty (60) days of receipt of the report, can demonstrate a need for continuation of the water level measurements.

3. WATER QUALITY

BWC shall operate all extraction systems for a period of not less than fifteen (15) years. Following that period, BWC may give notice of intent to discontinue operation of any single well and/or extraction system if six (6) consecutive samples collected from such well(s), extraction system, treatment system and associated monitoring well(s) in June and October of each of three (3) consecutive years demonstrates that the concentrations of the chemicals listed in Table I below are less than ten (10) times signal-to-noise using EPA Method 624 or 625. All analysis using EPA Method 625 shall be based on a 1000 ml sample concentrated to 2 ml of extract.

WATER QUALITY (Continued)

TABLE I

Parameter	Remedial Area A	B	C	D
1,2-Dichloropropane	X			X
Tetrachloroethylene	X			
Hexachlorobenzene	X		X	X
Carbon tetrachloride		X		
Hexachlorobutadiene			X	
Trichloroethylene			X	X

*All monitor wells shall be analyzed for chloroform during the above monitoring for the appropriate area(s).

If concentration levels for the appropriate area(s) are achieved, operation of the extraction well or extraction system(s) may be discontinued in accordance with the procedures set forth in Paragraph VI of the Consent Decree.

In any event, in June and October of each year beginning with the twenty-fifth (25th) year of the operation of the system on the South Works, BWC shall collect and analyze samples from each extraction well and monitor well then in operation, which collection and analysis shall continue until the end of the thirty (30) year period provided by the Consent Decree.

G. OTHER CONDITIONS

Within thirty (30) days of the receipt of any groundwater data under this remedial program, BWC shall provide the Department of Natural Resources with the numerical results.

BWC will provide thirty (30) days prior written notice to the Wayne County Public Works of its intent to discontinue the sampling of any groundwater source discharging to the Wayne County Public Works' Wastewater Treatment Plant.

OTHER CONDITIONS (Continued)

BWC shall make application to discharge the groundwater collected from these remedial systems to the Wayne County Public Works' Wastewater Treatment Plant. In the event the characteristics of the groundwater require Wayne County to impose pretreatment as a condition precedent to discharge, BWC may elect to comply with the County's pretreatment requirements or, alternatively, BWC may make application for direct discharge to the Detroit River. In the event Wayne County is required to reject the groundwater discharge from any of the above systems, BWC shall make application for the direct discharge of such groundwater to the Detroit River. Should BWC make application for a permit to discharge groundwater to the Detroit River, the Michigan Department of Natural Resources shall review the application in accordance with then applicable regulations and shall not unreasonably deny the permit. Provided BWC (a) gives notice to MDNR within five (5) working days of receipt of notice by the County of its intent to reject BWC's discharge, (b) applies for a permit for direct discharge to the Detroit River within sixty (60) days following receipt of such notice by the County, and (c) takes all reasonable steps necessary to maintain a permitted discharge to the POTW during the period following the County's adoption of the pretreatment requirements, the groundwater collection systems shall not be operated unless a permit to discharge to Wayne County or, alternatively, to the Detroit River, has been issued and remains in effect. If BWC challenges the necessity for or the validity of any permit condition, BWC shall construct, maintain and operate treatment technology which has been agreed upon by the parties or which has been determined to be appropriate by this Court under Paragraph VII.C. of the Consent Decree until such challenge(s) has been resolved.

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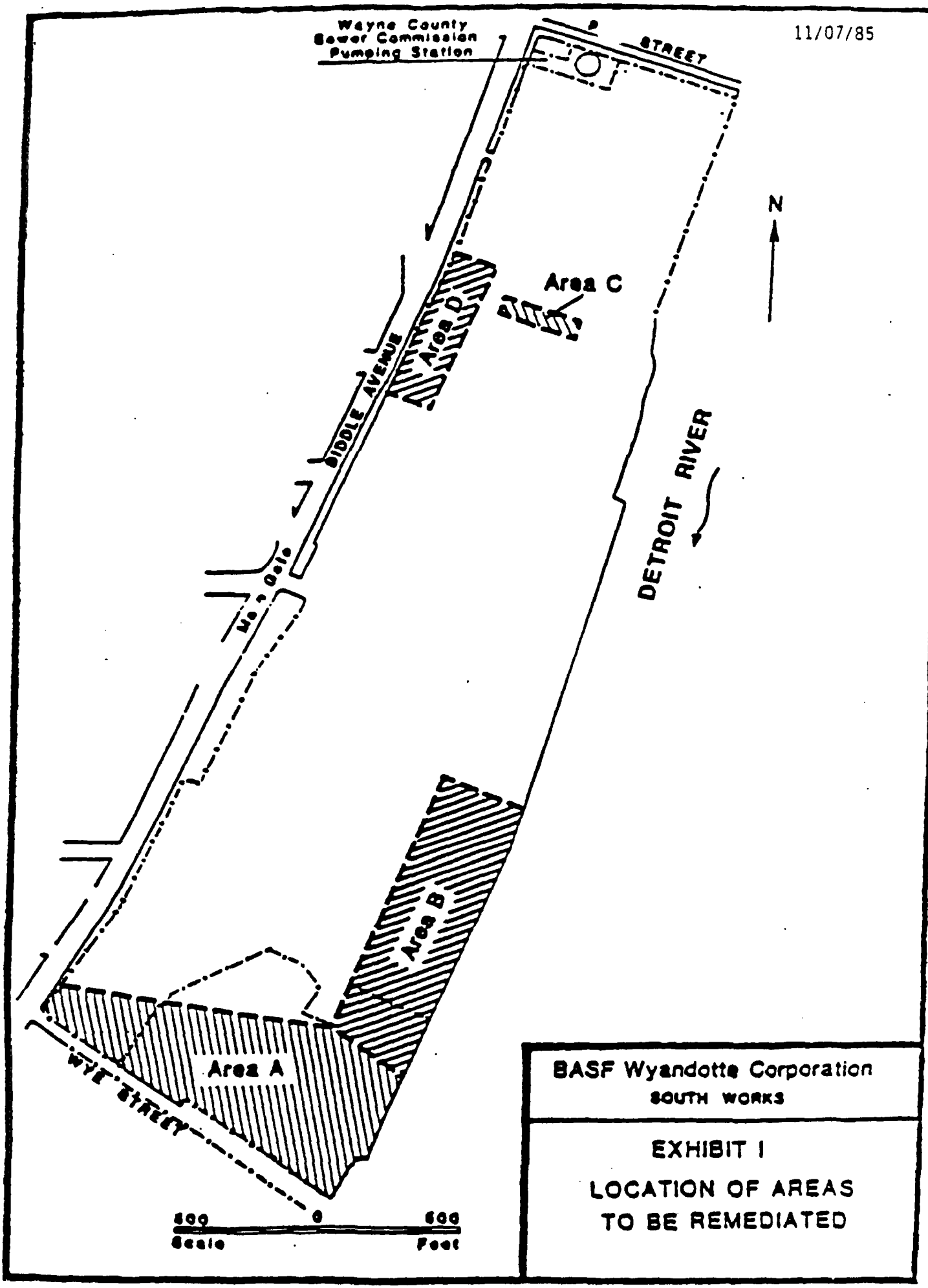
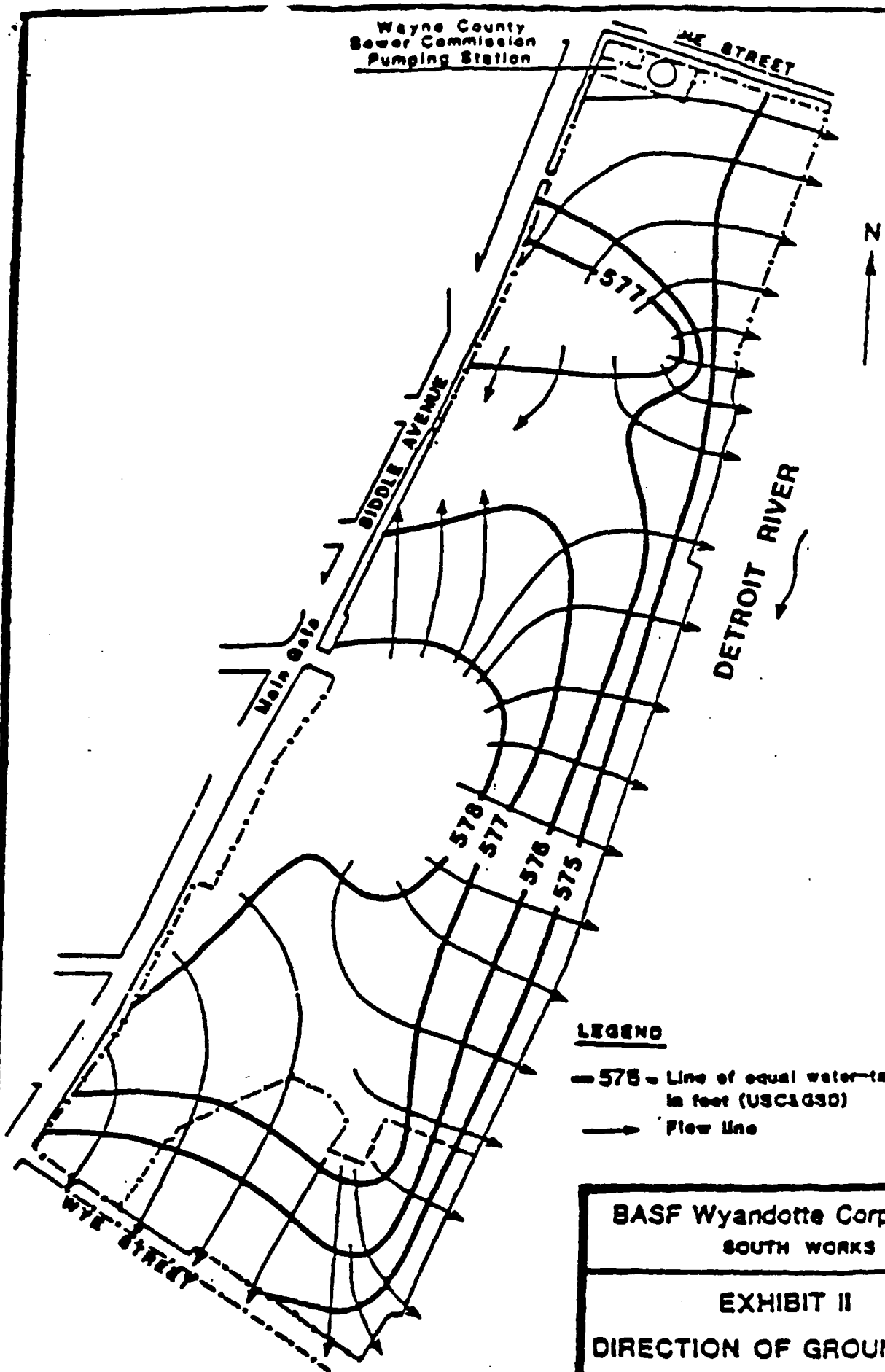
OTHER CONDITIONS (Continued)

Upon application by BWC at any time after a fifteen (15) year period, the Department of Natural Resources shall determine whether the operation of any of the above systems is no longer necessary to comply with conditions established by then existing law or regulations. If the operation of such systems(s) is not required, it may be discontinued. BWC shall bear the burden of persuasion by a preponderance of the evidence that continued operation of the system(s) is no longer necessary.

Soils and sludges excavated during construction of any groundwater collection system shall be managed in accordance with the law.


11/07/85
Wayne County
Sewer Commission
Pumping Station
STREET
N
Area C
Area D
BIDDLE AVENUE
DETROIT RIVER
Area B
Area A
WYE STREET
600
0
600
Scale
Feet
BASF Wyandotte Corporation
SOUTH WORKS
EXHIBIT I
LOCATION OF AREAS
TO BE REMEDIATED

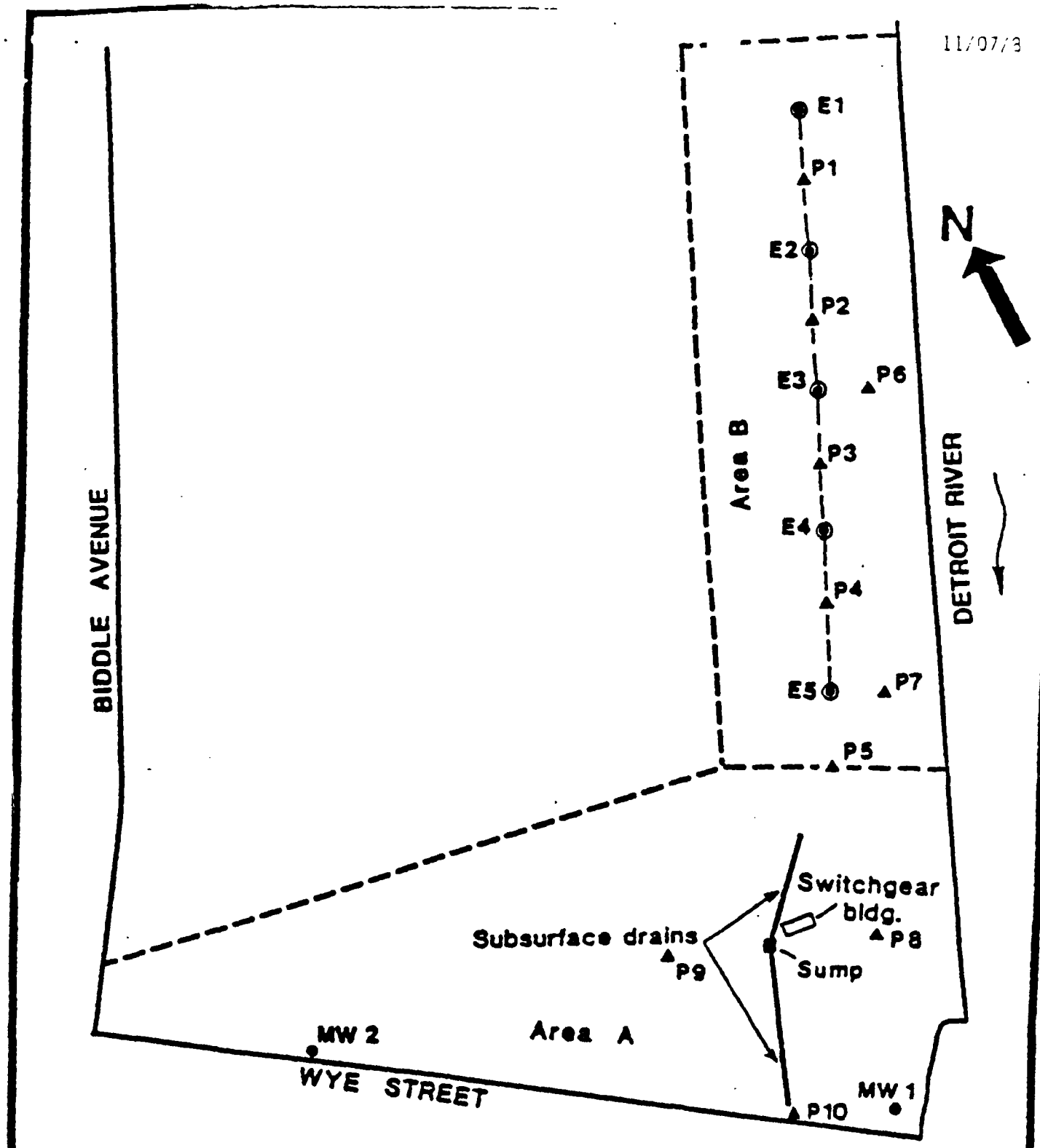
11/07/85



BASF Wyandotte Corporation
SOUTH WORKS

EXHIBIT II

DIRECTION OF GROUNDWATER FLOW UNDER AVERAGE WATER-TABLE ELEVATIONS



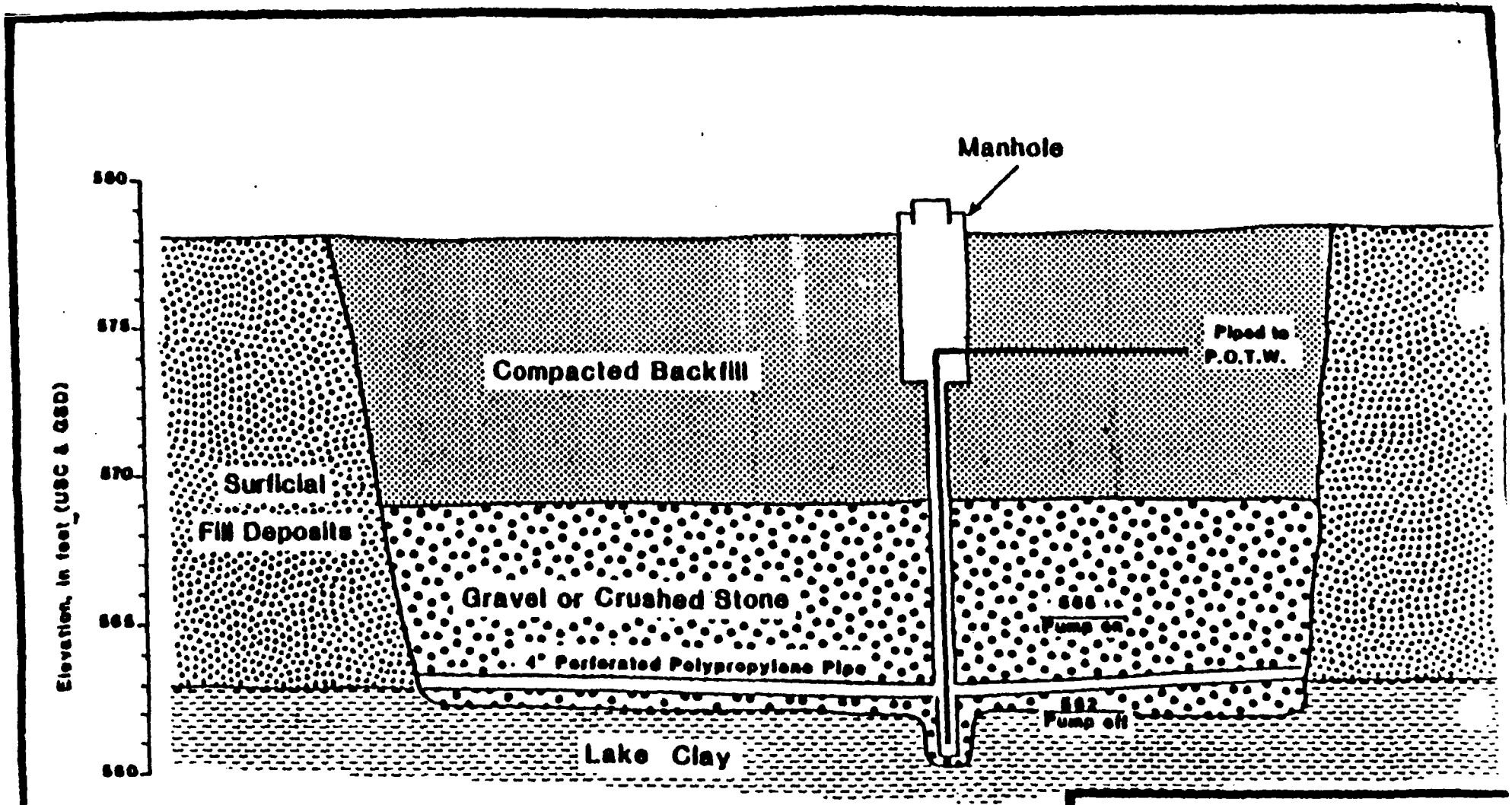
LEGEND

MW 1 • Monitoring well
E1 ● Extraction well
P1 ▲ Piezometer

200 0 200
scale feet

BASF Wyandotte Corporation
SOUTH WORKS

EXHIBIT III
REMEDIAL PLAN FOR
AREAS A AND B



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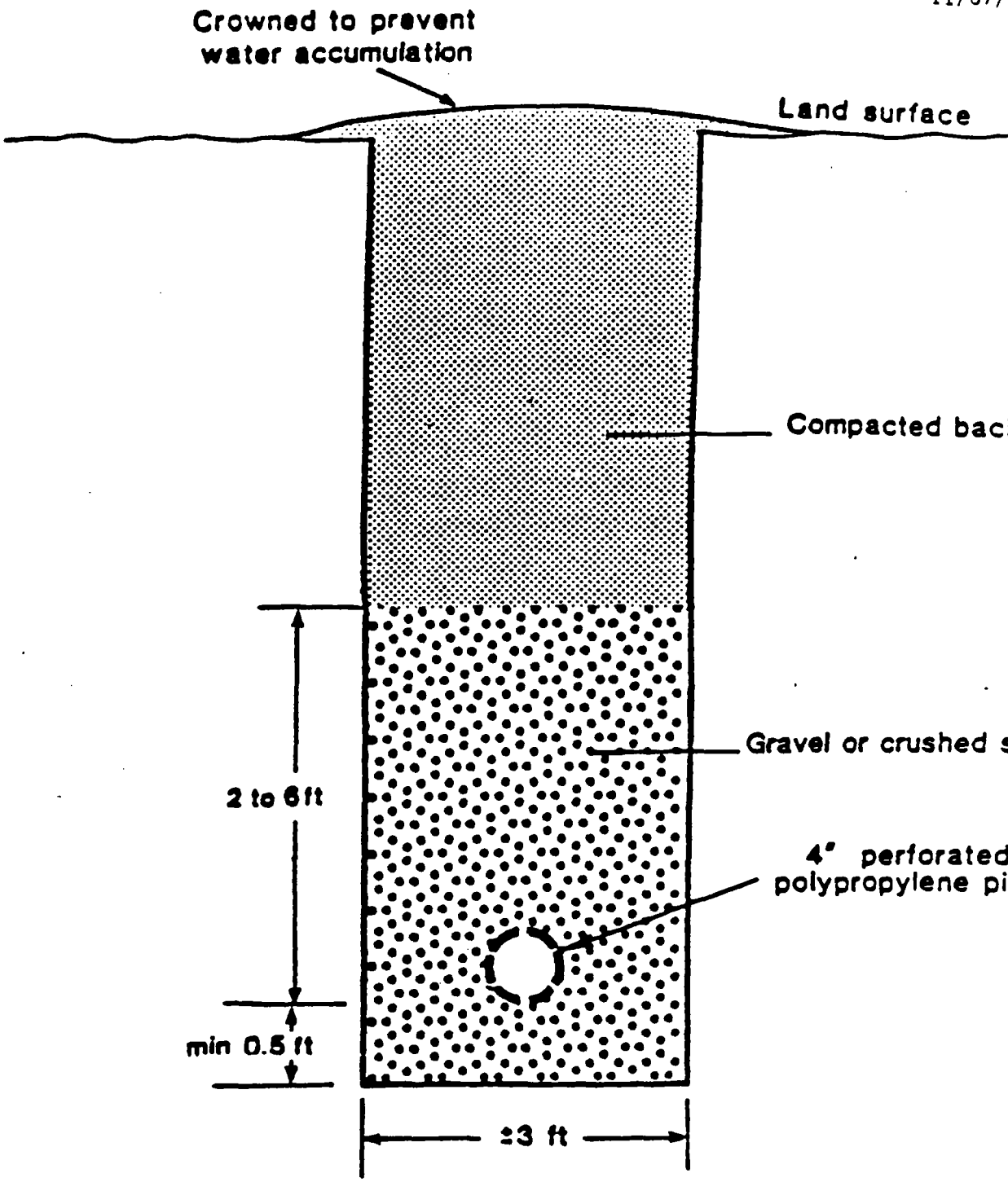
SOUTH WORKS

EXHIBIT IV
PROFILE ALONG
DRAINS - AREA A

11/07/85



NOT TO SCALE

BASF Wyandotte Corporatic
SOUTH WORKS

EXHIBIT V
SCHEMATIC DIAGRAM
OF TYPICAL
DRAIN CONSTRUCTION

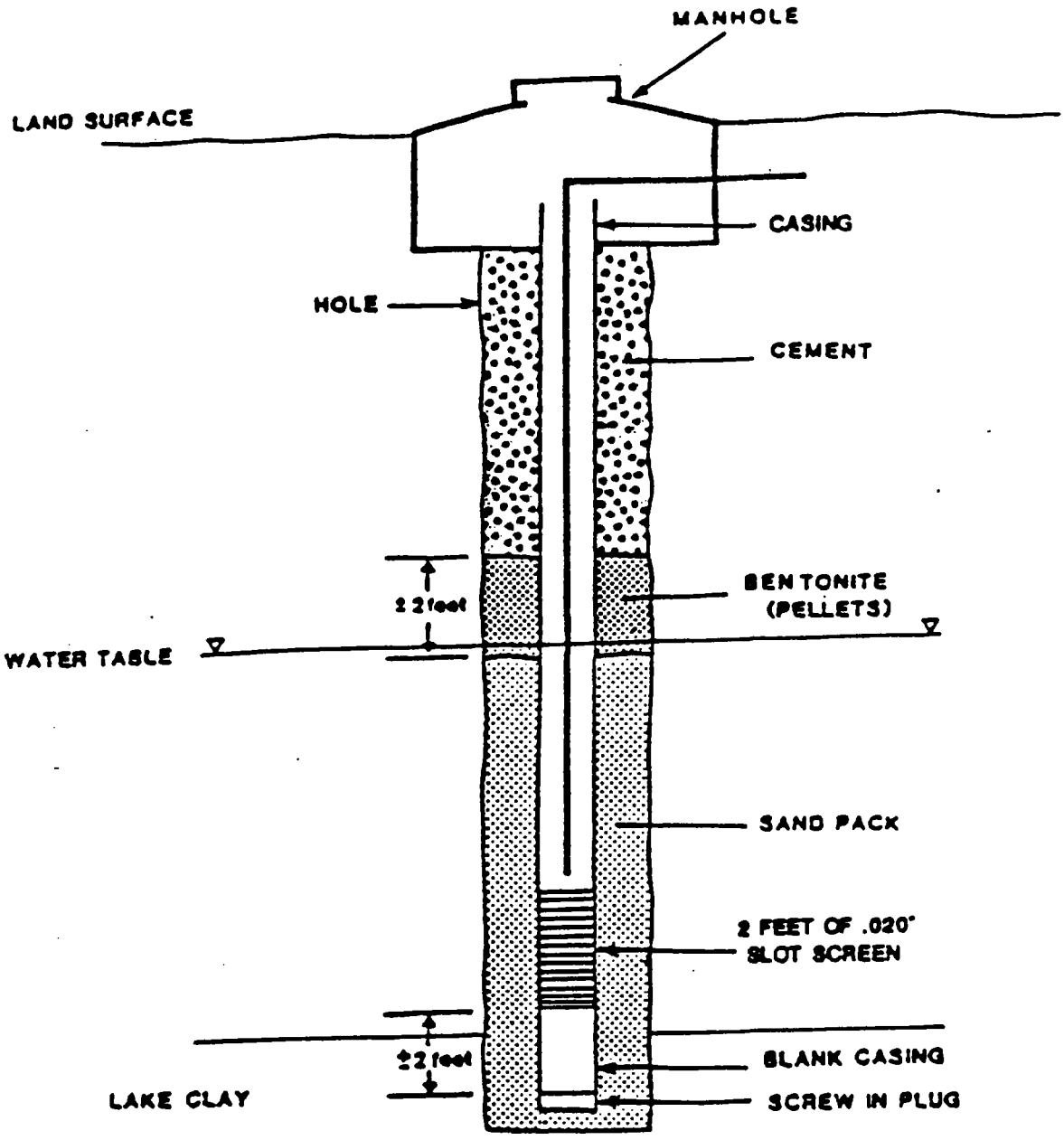


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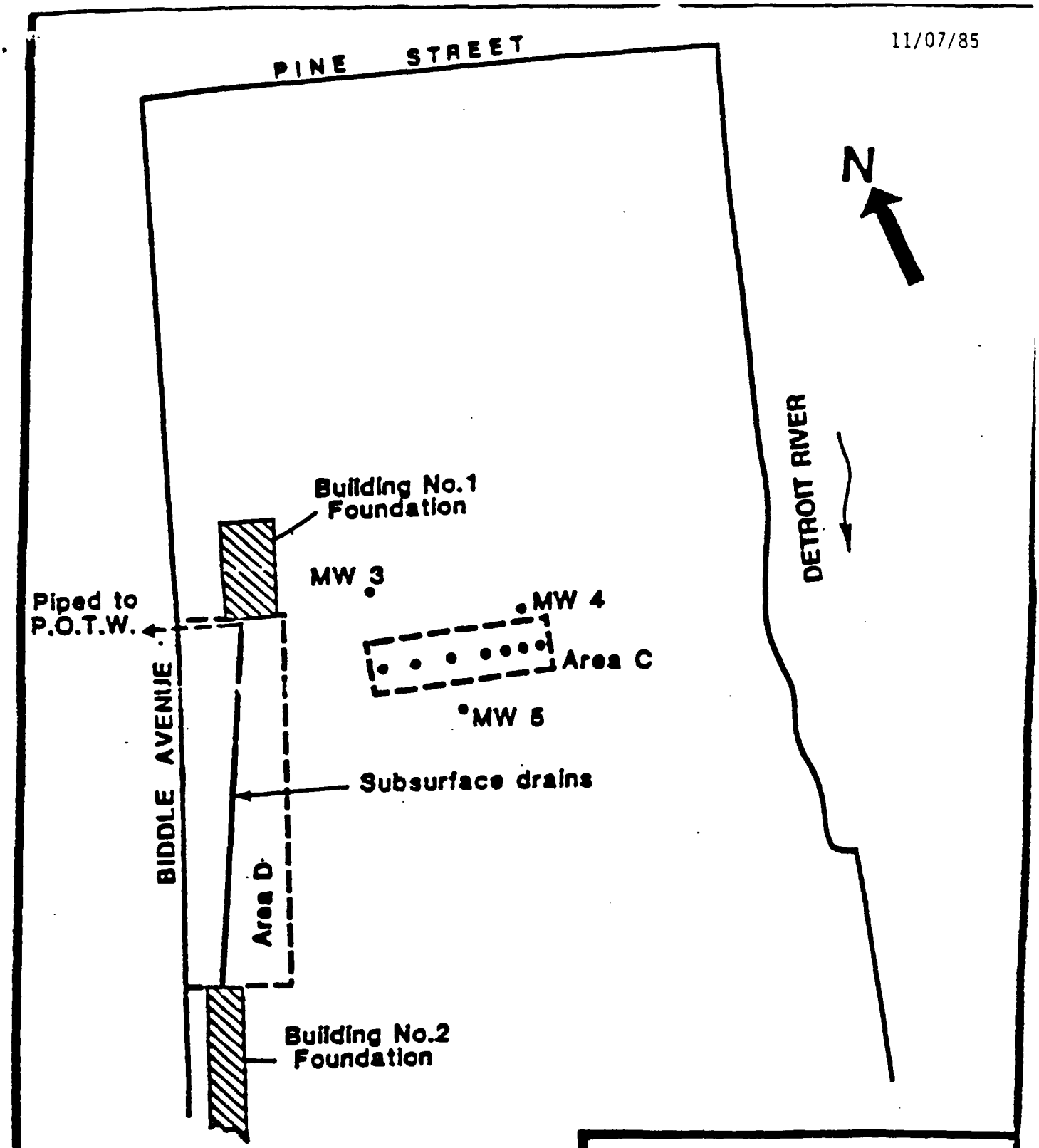
EXHIBIT VI
CONSTRUCTION DETA
OF EXTRACTION WEL
AREA B

11/07/85



LEGEND

MW 4 • Monitoring well

• Extraction well

200 0 200

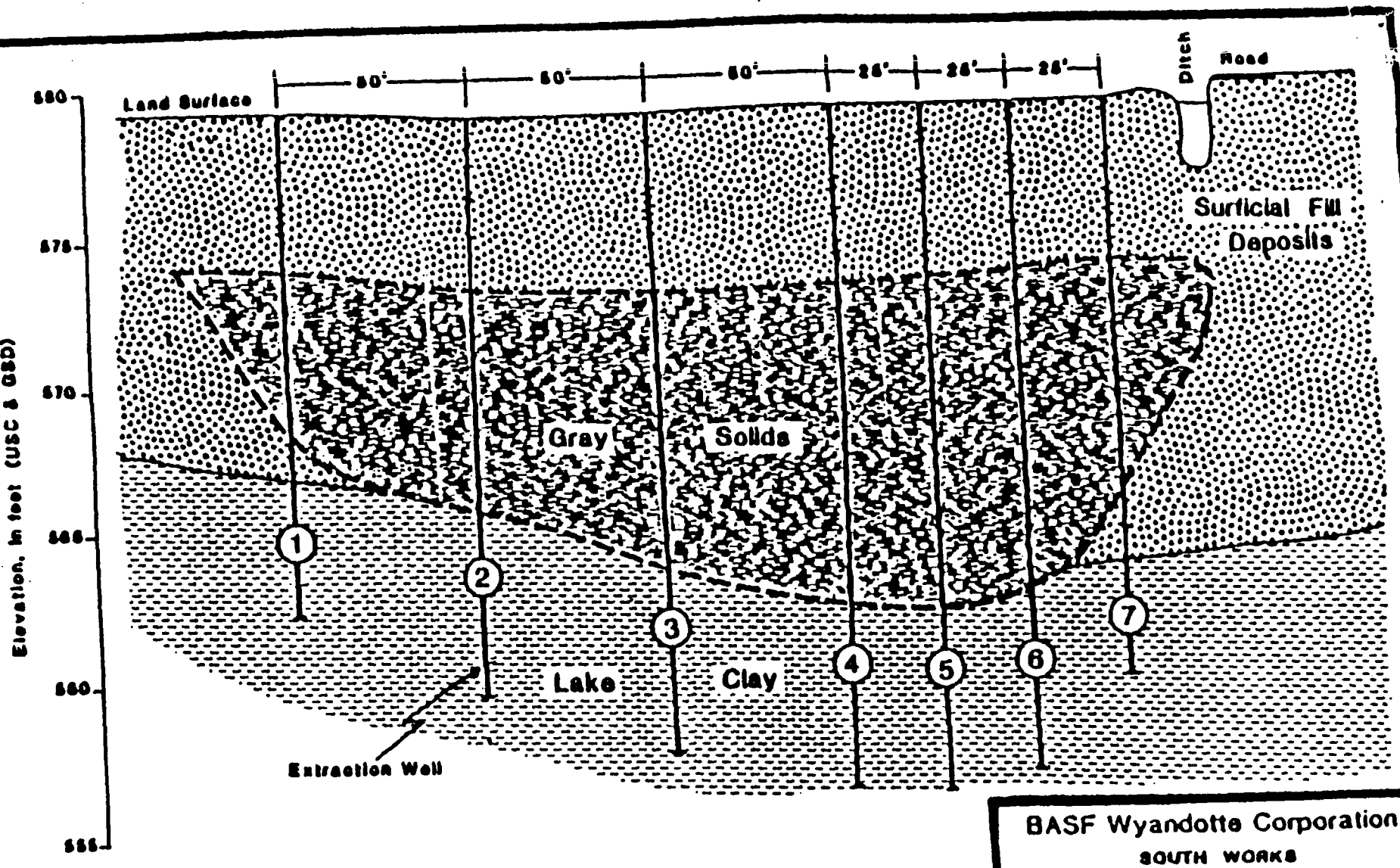
scale feet

BASF Wyandotte Corporation
SOUTH WORKS

EXHIBIT VII

REMEDIAL PLAN FOR

AREAS C AND D



NOTE : See Exhibit IX for extraction well construction details.

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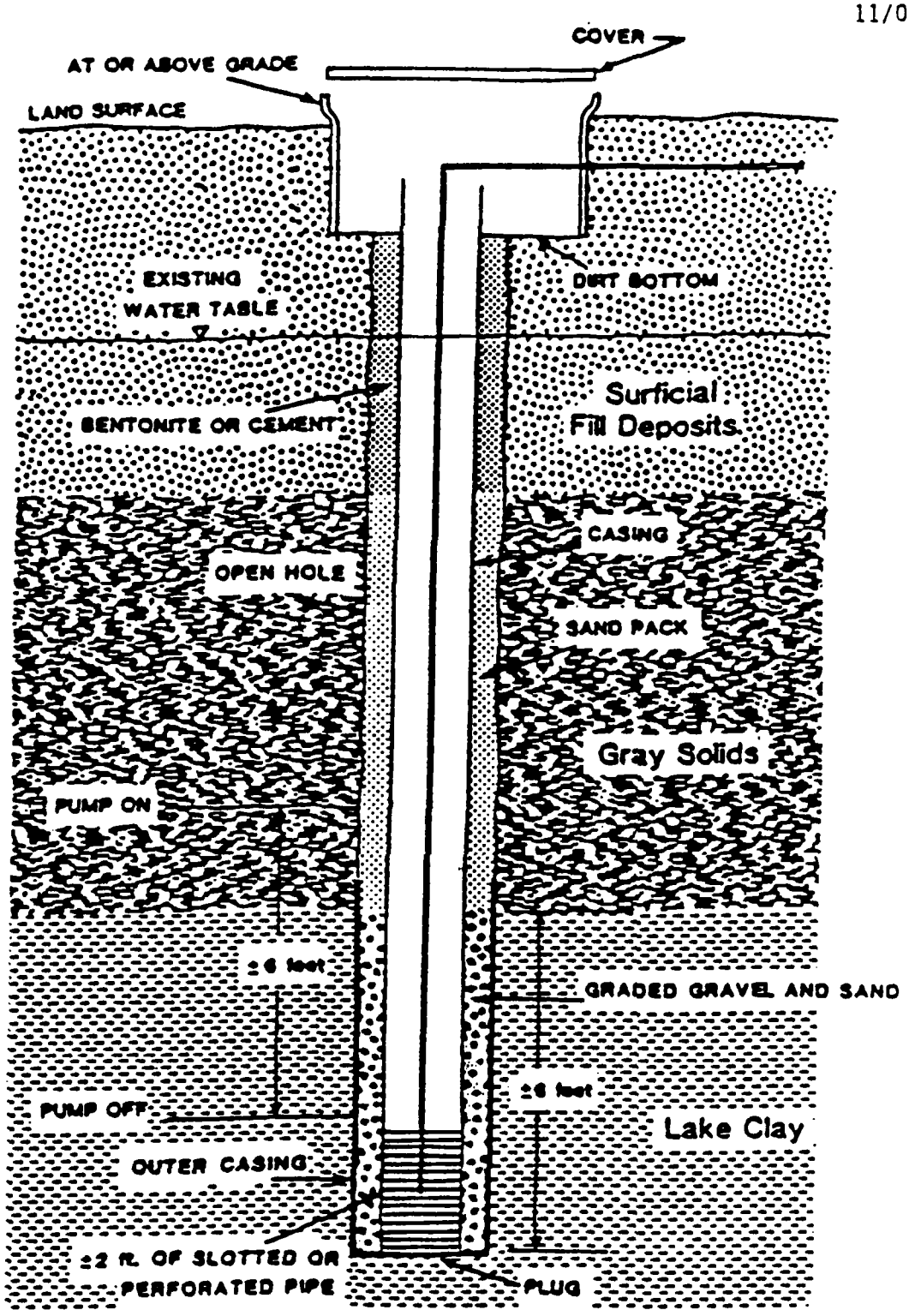
SOUTH WORKS

EXHIBIT VIII
PROFILE ALONG LINE
OF WELLS-AREA C

11/07/85

11/07/85



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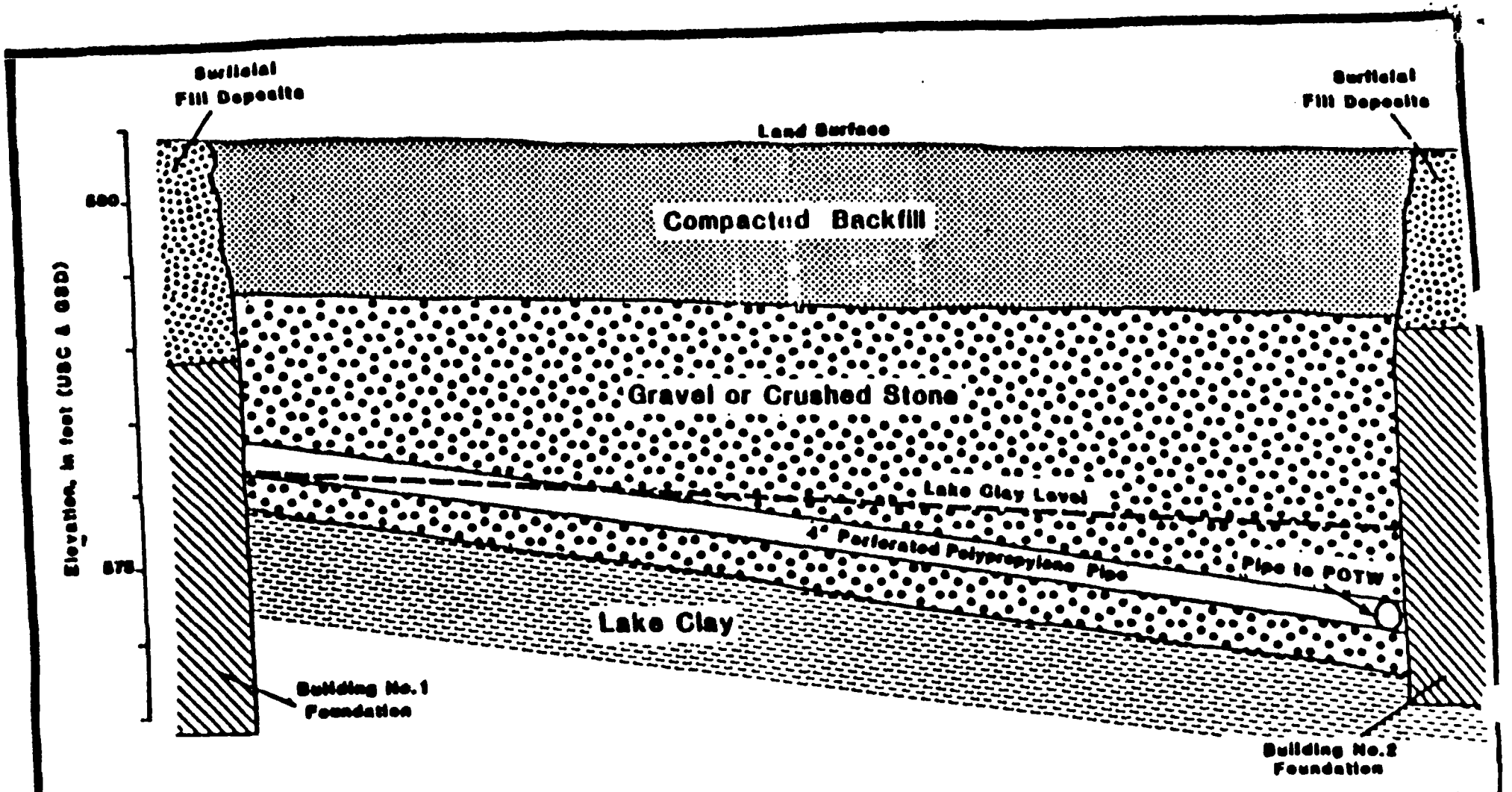
SOUTH WORKS

EXHIBIT IX
CONSTRUCTION DETAILS
OF EXTRACTION WELLS
AREA C



BASF Wyandotte Corporation
SOUTH WORKS

EXHIBIT X

PROFILE ALONG DRAIN – AREA D

11/07/85

BASF NORTH AND SOUTH WORKS

Styrene was found in the groundwater at sites 1 and 5 in concentrations from 45 to 730 micrograms per liter (ug/l). Styrene is toxic to land and aquatic organisms. Available data indicates that this chemical is carcinogenic to mice, causing an increased incidence of lung tumors. Styrene is mutagenic, having been shown to cause damage to DNA of test organisms.

Benzene was found in the groundwater at sites 1, 2, 4 and 5 in concentrations ranging from 13 to more than 200,000 ug/l. Benzene is designated as a toxic pollutant under § 307(a)(1) of the Clean Water Act, 33 USC 1317(a)(1). 43 Fed. Reg. 4108. Benzene is toxic to terrestrial life by ingestion, and highly toxic to aquatic organisms. It has also been shown to cause severe adverse effects on the blood forming organs, resulting in hyperplastic anemia, and decreased red and white blood cell counts. Inhalation exposure of experimental animals to benzene during pregnancy has resulted in birth defects. Benzene has been shown to cause leukemia after prolonged occupational exposures. The International Agency For Research On Cancer (IARC) has determined that there is sufficient evidence to indicate that benzene is carcinogenic to humans.

Hexachlorobenzene (HCB or C-66) was found in the groundwater at site 7 in concentrations ranging from 140 to 435,000 ug/l. Chlorinated benzenes are designated as toxic pollutants under § 307(a)(1) of the Clean Water Act. 43 Fed. Reg. 4108. HCB has been shown to be carcinogenic in mice and hamsters. HCB is toxic to land and aquatic organisms and is extremely persistant in the environment.

Hexachlorobutadiene was found in the groundwater and sediments at sites 1 and 7 in concentrations from 0.10 to 800,000 parts per billion (ppb). Hexachlorobutadiene is designated as a toxic pollutant under § 307(a)(1) of the Clean Water Act. 43 Fed. Reg. 4108. Hexachlorobutadiene is a potential animal carcinogen and has been shown to cause kidney tumors in laboratory rats. It is toxic to mammals and extremely toxic to aquatic life. Chronic exposures result in kidney damage in animals.

organs, and testes, are preferred target organ tissues for PAH effects. Signs of toxicity are generally not seen at doses less than those which produce a high tumor incidence.

Polychlorinated Biphenyls (PCB's) were found in the soils of the emergency containment pond in concentrations of 5.5 parts per million. PCBs are designated as a toxic pollutant under § 307(a)(1) of the Clean Water Act. 43 Fed. Reg. 4108. PCB mixtures have been shown to induce liver cancer in mice and rats. PCB mixtures may have mutagenic potential. PCBs are extremely persistent in the environment and have been shown to be highly bioaccumulative in the food chain.

Arsenic was found at site 3 and 5 in the groundwater in concentrations from 20 to 2,000 ug/l. The National Interim Primary Drinking Water Standard for arsenic is 50 ug/l. Arsenic is designated as a toxic pollutant under § 307(a)(1) of the Clean Water Act. 43 Fed. Reg. 4108. Arsenic is a human carcinogen, causing increased incidences of skin and lung cancer in exposed populations. Other effects include peripheral neuropathy and peripheral vascular disorders such as black foot which is seen in Taiwan in areas with high arsenic concentrations in the drinking water. Arsenic compounds have been shown to readily cross the placenta in humans and test mammals, causing fetal toxicity and malformations. Arsenic is highly toxic to fish and other aquatic life.

Hexavalent Chromium was found at sites 2 and 4 in the groundwater in concentrations ranging from 120 to 550 ug/l. Chromium is designated as a toxic pollutant under § 307(a)(1) of the Clean Water Act. 43 Fed. Reg. 4108. Hexavalent Chromium is generally recognized as the more toxic form of chromium. The Ambient Water Quality Criterion recommended for hexavalent chromium is 50 ug/l, which is identical to the National Interim Primary Drinking Water Standard. 45 Fed. Reg. 79331. The primary adverse effects seen from acute overexposures to chromium are to the kidney, as tubular necrosis.

Toluene was found at sites 1, 4 and 5 in the groundwater at concentrations from 610 to 40,000 ug/l. Toluene is toxic to laboratory animals and to fish and has been designated as a toxic pollutant under § 307(a)(1) of the Clean Water Act. 43 Fed. Reg. 4108. For the protection of human health from the toxic properties of toluene ingested through water and contaminated aquatic organisms, the Ambient Water Quality Criterion has been determined to be 14.3 mg/l. 45 Fed. Reg. 79340.

RATE AND DIRECTION OF GROUND-WATER FLOW AT THE SOUTH WORKS BASF WYANDOTTE CORPORATION WYANDOTTE, MICHIGAN

EXECUTIVE SUMMARY

The BASF Wyandotte Corporation's South Works consists of 84 acres adjacent to the Detroit River in Wyandotte, Michigan. The site is underlain by a wedge of surficial materials consisting mostly of fill material with some fluvial sand and peat. Lake clay, about 40 to 70 feet thick, underlies the surficial materials. Hydrogeologic investigations were conducted to determine the rate and direction of ground-water flow within the surficial materials.

The investigations included the installation of 26 observation wells, the systematic measurement of water level in the 26 new and 4 existing observation wells from December 14, 1983 to August 3, 1984, and the conduct of hydrologic tests in all wells. Data obtained from these field investigations were evaluated to define the nature and distribution of the surficial materials, estimate their hydraulic properties and assess average ground-water flow conditions at the site and seasonal variations from these conditions.

The results of these evaluations indicate that in the northern part and in the eastern half of the central and southern parts of the site ground water flows toward and discharges into the Detroit River. In the southwestern part of the site ground water flows toward Wye Street and leaves the site across its southern boundary; and in the central western part of the site flow is toward Biddle Avenue and ground water leaves the site across its western boundary.

Ground water discharging from the site is mostly derived from recharge by infiltration on the site. The character of the surficial materials and, hence, the rate of recharge differs from place to place within the site.

The total ground-water discharge from the site is about 30 gallons per minute (gpm) under average ground-water conditions and may range from as low as 10 gpm during periods of low water table to as much as 40 gpm during periods of high water table. About 29 gpm of the total average discharge is into the Detroit River with slightly less than one gpm discharging across the southern boundary and less than half a gpm across the western boundary. More than half of the discharge into the Detroit River, or about 16 gpm, occurs across a 700-foot width of the riverfront and originates from an area that receives recharge from ponded runoff.

POINT HENNEPIN

Long Range Site Improvement Program

Grosse Ile Township, Michigan

BASF Wyandotte Corporation
1609 Biddle Avenue
Wyandotte, Michigan 48192

T. B. Piper - Manager of Wells
313-282-3300 X6495